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POPULAR MECHANICS

MAGAZINE

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JANUARY 1959
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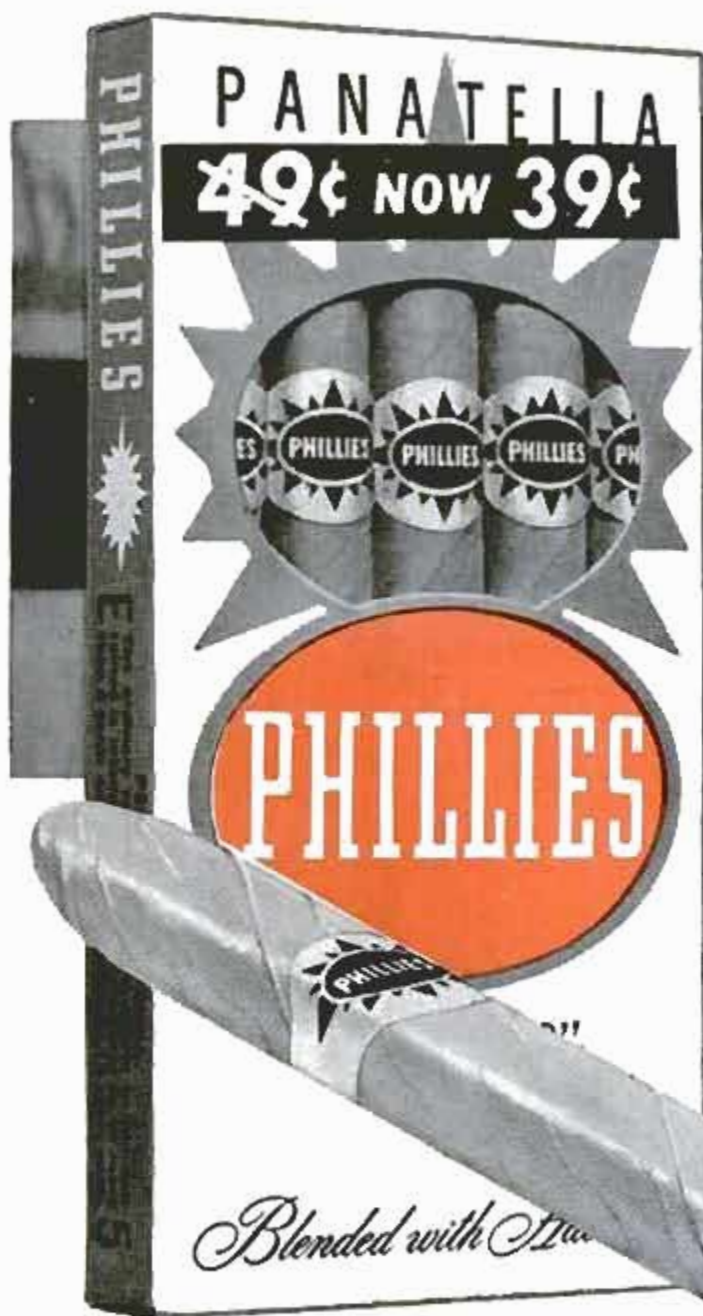
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This One



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Next Month...

ARE YOU a railroad fan? A PM editor reports next month on his ride in the cab of the newest railroad giant, an 8500-horsepower gas-turbine locomotive on the Union Pacific. DRAG STRIP BUG? A February article tells how the new "sling-shots" are burning up the strips. YEARNING TO BE a jet pilot? An American Airlines captain writes in the next issue of his job—training the veteran piston pilots to fly the Boeing 707 airliners over the transcontinental routes

How I retired in 15 years with \$300 a month

"Some things you remember always. And one was an afternoon Doc Mason and I spent fishing in May 1943. It's solely because of him that I'm retired today—only 15 years later, with \$300 a month that no recession can take away.

"Doc and I got to talking. I'd just been turned down by the Army. I admitted it had kind of shocked me. Although I felt young, I was *too old*.

"Doc looked at me sideways and said, '*Everybody's surprised when he's forty*. People really don't feel different then—but they *are* different. And the ones who are happiest are the ones who do something about it.'

"I said, 'I always figured I had plenty of time ahead. But now I see that I'm actually at my peak. I may not earn more and more. And I may not *save it*.'

"Doc said, 'Some people don't figure *that* out till they're sixty. And that's too late.' He looked thoughtful and said, 'Where would you like to be 15 years from now?'

"Well, I hedged, 'You can't plan—with the war on.'

"That's just it,' said Doc, 'there's always a war or something. Never a time when things are certain. Never a *best* time to plan. But I've seen lots of people who *thought* they wanted to work forever change their minds at sixty. *Then* they want to take it easy, stop worrying.'

"But, I said to Doc, 'What can I do?' Salaries were frozen in '43. Raises weren't much.

And I'd never been able to save much more than I put in my insurance and the house.

"It was then that he told me that, in his experience, the people who had the fewest ulcers were those who *included* something in their insurance to provide for their retirement, as well as for their families. 'There are ways,' he said, 'of making your salary now provide you a retirement income later.'

"I kept turning that over in my mind. And later that week, in Life magazine, I saw an ad for the Phoenix Mutual Life Insurance Company. It told how a man with a good job, but no big savings, had retired in 15 years with \$300 a month. Well, I thought, *it can't cost anything to look into it*.

"I did. And now, 15 years later, I'm mighty glad. I retired *before sixty*. I'm getting a check for \$300 a month, each month, every month—with no worry about the next one. It's something anybody can do, if he stops and thinks about it in time."

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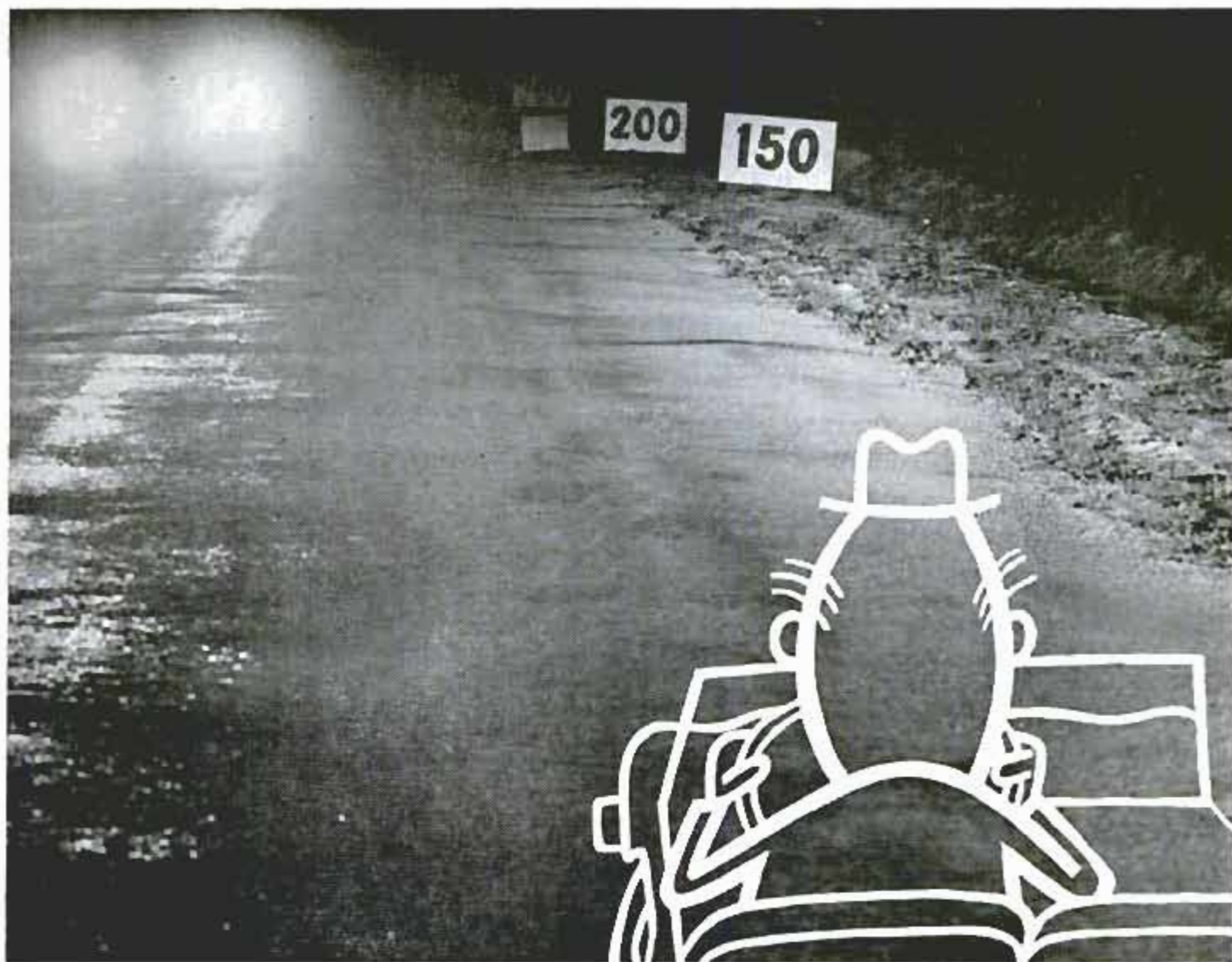
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jects more light along the right shoulder, helps keep your eyes on your side of the road. Now you can spot that fallen box at the 200-foot mark—which you *couldn't* see with old headlamps.

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ACROSS THE DESK



No subject brings us more comments from readers than the "Detroit Listening Post," the once-a-month "Owners Reports" that tell you what car owners themselves find good and bad in their automobiles, and the year-end issues in which we report the new models.

This being our annual automobile issue, we present a few of these comments from mail of recent months. We'd like to print them all, but obviously that is impossible. It's human nature that the vast majority of motorists are completely sold on their own make; it's also human nature that those who voluntarily write letters about cars are often the severest critics. Here, then, are some excerpts from the interesting letters you and others have written us:

Your article "What Engineers Say About Today's Cars" [August] leads one to make this statement: If automotive management were suddenly finding their best-qualified engineering personnel leaving to take positions where "down to earth" objective engineering rates, and where the efforts of research show up as useful improvements in the product (instead of being used to find ways to motivate consumers to buy what they want to sell them), I'm sure there would be some return to a sense of basic values on the part of such management.

Edward Kramer,
Cincinnati, Ohio.



This is the first time I have ever read a PM magazine, mostly because I am not much of a mechanic (popular, or otherwise) and I think it is astounding. I am celebrating the occasion by writing my first letter to any editor. The comment that really spurred this was in your report on the "Olds" [June]: "The public is buying foreign-made scooters for one reason only: gasoline economy; etc."—by an Alabama accountant. Now, I don't know exactly why the "public" is buying these "scooters" (you can tell the implication really ices me) but I'm real happy to say that our part of it (my husband, our four sons, and me) didn't buy our little jewel for that reason. We have been driving GM cars since our marriage eight years ago and the latest was a hardtop beauty of a Buick; and we have no complaints. Fortunately we are stationed in Germany where there are narrow

(Continued to page 10)

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(Continued from page 6)

cobblestone roads or we never would have bought our '58 Opel Caravan. We had a problem: the four active youngsters just couldn't be accommodated in our great big Buick (ironically: no room) and fighting the many narrow travel routes in a "big" car was becoming a hazard . . . hence the Opel and how neatly she solved our dilemma! Now that we are in our Opel I'm almost positive we'll never put out \$4000, or its equivalent, for an automobile again. Unlike your Alabama accountant, we think the Opel (other models included) is one of the sharpest shapes on the road and those great, hulking American cars are beginning to look a little ridiculous, like somebody wearing diamond-studded underwear. But beyond the looks that are a matter of taste anyhow, the car is a masterpiece. We get a smoother ride on these terrible roads and not a rattle yet. With the chrome luggage rack on top we have more than enough room and, with another couple plus camping equipment and luggage, went to the world's fair, getting 33 miles to the gallon. They ordered an Opel as soon as we arrived home. The engine doesn't ping and is everything the size and weight of the car needs and it handles best at a *safe speed!* The interior is lovely, durable and wipe-off-able. In fairness, I will state some of the drawbacks, if you think of them as such: If you are overweight and under-spry you may have a little difficulty getting into the back seat as she is a two-door, so the kids can't exit at 50 m.p.h. You have to shift the gears, but she handles as though she were in the palm of your hand. When we want another car we'll get one, but the Opel stays.

P.S. I hope our Cadillac drivin' "uncles" read this! We live in Wiesbaden, Germany.

Mrs. Wm. N. Walker,
c/o 1/Lt. W. N. Walker,
A Btry., 443rd. AAA Bn.,
APO 633, New York City

☆

I read with interest your "Owners Report on the Rambler American." Under the complaints a Missouri owner said "Windows in rear should roll down." Recently I wrote to Mr. Romney, president of American Motors, that the American "Deluxe" [lower-priced series] didn't have roll-down rear windows.

In a short time I received a kind letter from Mr. Romney in which he stated that only a few Rambler Americans were made that didn't have roll-down rear windows. Crank-type windows were installed shortly after production started.

(Continued to page 14)

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The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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Name.....Age.....

Address.....

City.....Zone.....State.....

(Continued from page 10)

Also, those who said gas mileage wasn't sufficient will want the free booklet put out by American Motors which tells how to get better gas mileage in all cars.

Bruce Lowry,
Dayton, Ohio.

☆

Long after most car owners have forgotten the good features of their cars, they have *total recall* of the poor workmanship and sloppy assembly, the aggravation of repeated expense and loss of valuable time in having numerous factory-built defects repaired. . . . The main reason . . . they do not complain to top management long enough and strong enough to get results.

R. Blagden,
East Hampton, Conn.

☆

I am very glad to see that you are going to make your annual report on the '59 automobiles. I hope this will be as good as your past reports.

Tom Cygan,
East St. Louis, Ill.

☆

Any improvement we've made in engines has been to make them faster, rather than capable of doing their job; it takes an expert to find out what's wrong with these high-compression engines and nothing is made simple and compact. . . . The simpler it is, the better the product and the more people will buy it. . . . About 75 horsepower is sufficient. . . . People want smaller cars and less horsepower, and they want designing, yes, but not necessarily these little sports models that won't even hold an extra pair of shoes. There's no room in the parking lots and no room on the roads for so many of us.

M. S. Benjamin,
Richmond, Va.

☆

I enjoyed your story on camping [May] because we were planning our first camping trip, in Europe. Europe is a camper's paradise. Each country has many camping sites, usually near scenic rivers and lakes. All one has to do to find a place to camp is watch for signs along the highway, then look for the tents. We traveled over 2500 miles in eight countries and the three-week trip cost under \$300. [The campers: Sergeant Carrie, Mrs. Carrie and four sons aged 19, 9, 6 and 3.]

Owning and operating camping sites in America could be a profitable business. All

(Continued on page 16)



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(Continued from page 14)

that is required is a piece of ground, grassy field, shade trees, drinking water, sanitation facilities and trash containers. Most of the camping sites here also have a small grocery store—another way to make money.

M/Sgt. Clyde E. Carrie,
36th Fld. Maint. Sq.,
APO 132, New York City

☆☆☆

PM House Sprouts in Michigan

The summer home-basic house that PM's New York editor, Richard F. Dempewolf, built in Pennsylvania's Pocono Mountains is the home Frank A. Dawson has built for himself at Republic, Mich. Mr. Dempewolf's cabin was the basis of articles beginning in the March issue of 1955 and later



appeared in the book, *Popular Mechanics Pre-Cut House*, which gave home builders complete instructions for building it.

Mr. Dawson, who started building his home (pictured above) in 1957, writes: "I changed the windows and doors to suit myself, but otherwise used your plans exclusively and it has been a very easy home to build. So far [with inside walls unfinished at time of writing] I have 1,004 hours on it, all in my spare time, with no hired help." He installed a gas furnace and water pump in a crawl space.

☆☆☆

To the Editor:

I read your article "Festival of the Iron Men" and have just one criticism. The threshing steam engine came in about 1860, drawn by horses. And as early as 1867 the Russell Threshing Machine Company had a steam engine with a man steering it. However, in the state of Ohio, even if you had a self-steering steamer the law required you to put a team of horses ahead of the engine when traveling a public road, for "safety" reasons.

Our association had the first revival of the "threshing bee" on Oct. 12, 1941. Our biggest crowd was in 1953, when about 14,000 people attended.

(Continued to page 20)

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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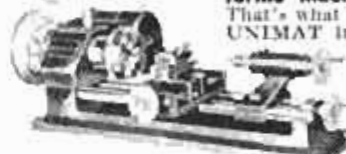
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(Continued from page 16)

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Joseph T. Rynda, Jr.,
President, Pioneer Historical
Association of Montgomery, Minn.

☆☆☆

To the Editor:

I got quite a charge out of your article in the September issue, "Festival of the Iron Men." I saw two of those old engines sitting under a tree in Logan County, Okla., when I was back there in 1957 . . . my wife and I both remarked about them at the time. . . . Thought I would drop you a line about them as I was quite overwhelmed by your article.

Dale F. Thomas,
Ukiah, Calif.

☆☆☆

To the Editor:

In your October [1957] ^{P. 110} issue I noticed a picture of a snow sled. I also built one; the state issued me a license for it so I can drive it on the highway. It's equipped with horn, lights, hydraulic brakes; skis can be detached in seconds. Equipped with trailer



hitch, it can be pulled behind the car for long trips. It is powered with a 75 Continental engine, and has been clocked at 85 miles per hour on the highway. It seats three people.

Peter J. Fuchs,
Avon, Minn.

☆☆☆

To the Editor:

Just thought I'd drop a line to tell you that your article on bass fishing [July 1958] was very good. This was the best fishing article I ever read.

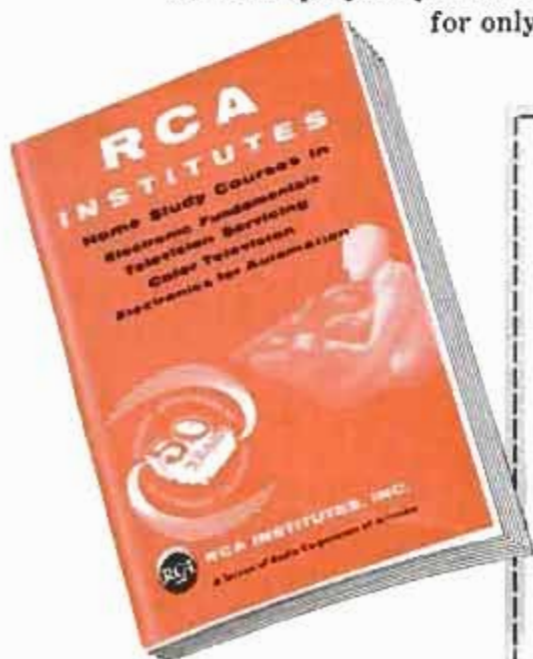
Thomas King,
Brooklyn, N. Y.



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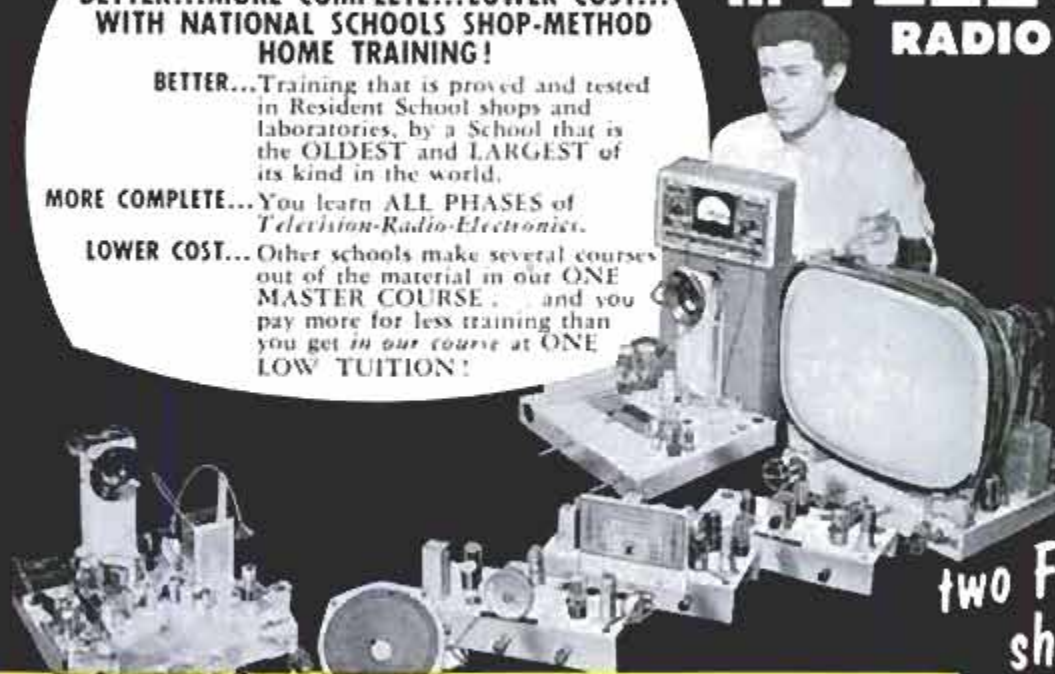
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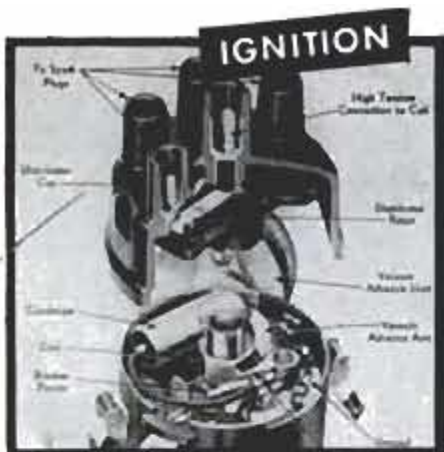
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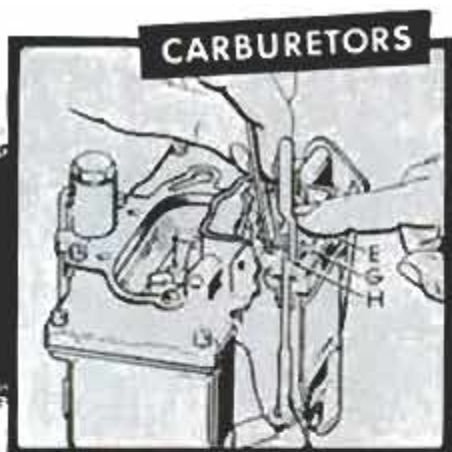
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I took a timetable out of my suitcase and began reading quietly in the manner prescribed, the names of about one hundred railway stations. I observed that, after reading them over a few times, I could recite the whole list off with hardly a mistake. With a little more practice I found I had committed them so completely to memory that I could remember them in the reverse order and even pick out one station from the list and say which number it was, and what were the names of the towns before and after it.

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We Help You Grow

YOUR personal success is of the utmost importance to Hdqtrs, for as you grow so grows the Duraclean Dealer organization. Thus, your initial training is only the start of a continuous assistance program to help build your business. When you write or phone Hdqtrs, you receive prompt, expert counsel from specialists. Among 25 regular services you receive are conventions, regional conferences, product development, tested ads, monthly magazines, etc. Cooperative program and customer satisfaction built this world-wide organization.



Unique Process

Duraclean cleans by *absorption*, utilizing electric Foam-ovator (shown above) which produces a light aerated foam. When spread onto fibers or fabrics, chemicals in foam safely and gently loosens soil and absorbs it like a blotter absorbs ink; thus, eliminating scrubbing, soaking, shrinkage, color run or dry rot. This unique process revitalizes fibers, restores color and adds years to their life. "On location" cleaning also permits use of furnishings again the same day. Customers are so elated they become your best salesmen. You also provide 4 other services to increase profits: **soil retarding, mothproofing, flameproofing and spot-tinting.** As a specialist you provide a complete service.



What Manufacturers Say

" . . . (Duraclean) standards in keeping with service to which . . . carpets and consumer are entitled." —Avisco (American Viscose Corp)

" . . . superior to any on-location process with which I'm familiar." —President, Modern Tufting Co.

" . . . we approve this process . . . in keeping with better service to Mrs. Housewife." —Aldon Rug Mills

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Trade Advertising: More and more retailers are referring customers to Duraclean Dealers for servicing. Key trade journals target local furniture retailers, dept. stores, dry cleaners, decorators, etc., to become agents for you.

To coordinate both trade and consumer campaigns in your town, we provide you with tie-in materials as ad reprints, mailing pieces, display cards plus others.



What Dealers Say

W. Looklebill (St. Louis): My 28th year! Began during depression and built business on good service.



D. Chilcott (N. Platte): Duraclean say gross \$9.00 per hour. I gross up to \$12.00. Many dealers do much better.

M. Lyons (Chgo): 3rd year should hit \$100,000; 2nd was \$60,000; 1st was \$40,000. Hdqtrs help make it possible.



E. Roddey (Hampton, Va.): Did \$600.00 first 12 days in January. My business keeps growing each month.

A. Wilson (Tulsa): Made \$1,299 this month working alone. Duraclean outperforms all competitors.



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Famous Magazine Illustrator

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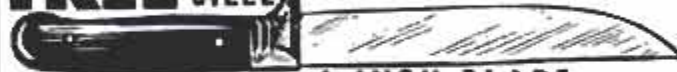
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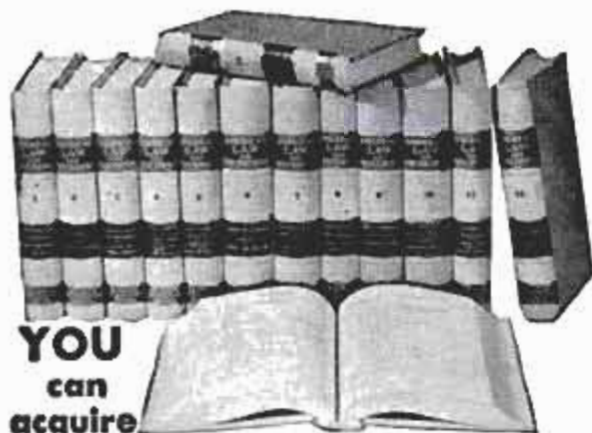
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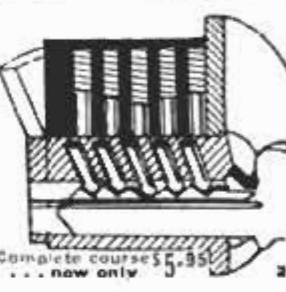
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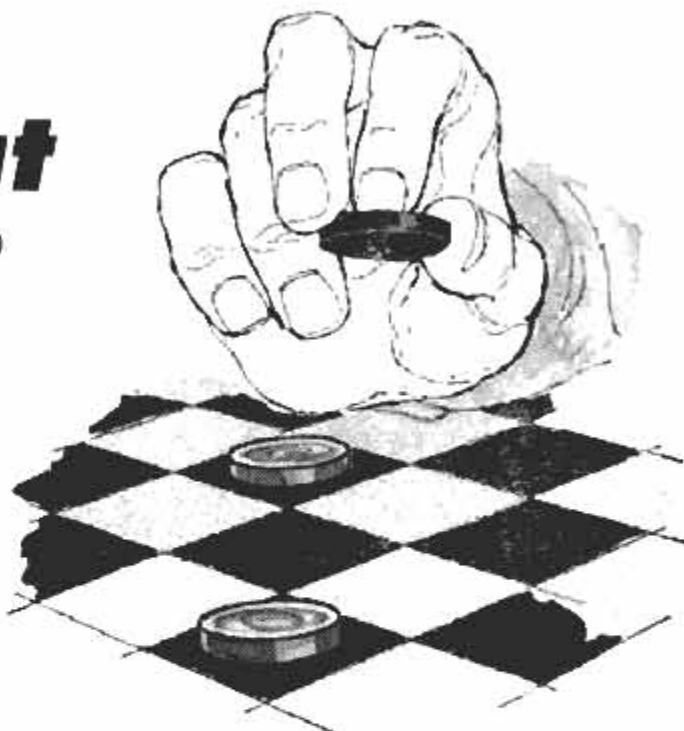
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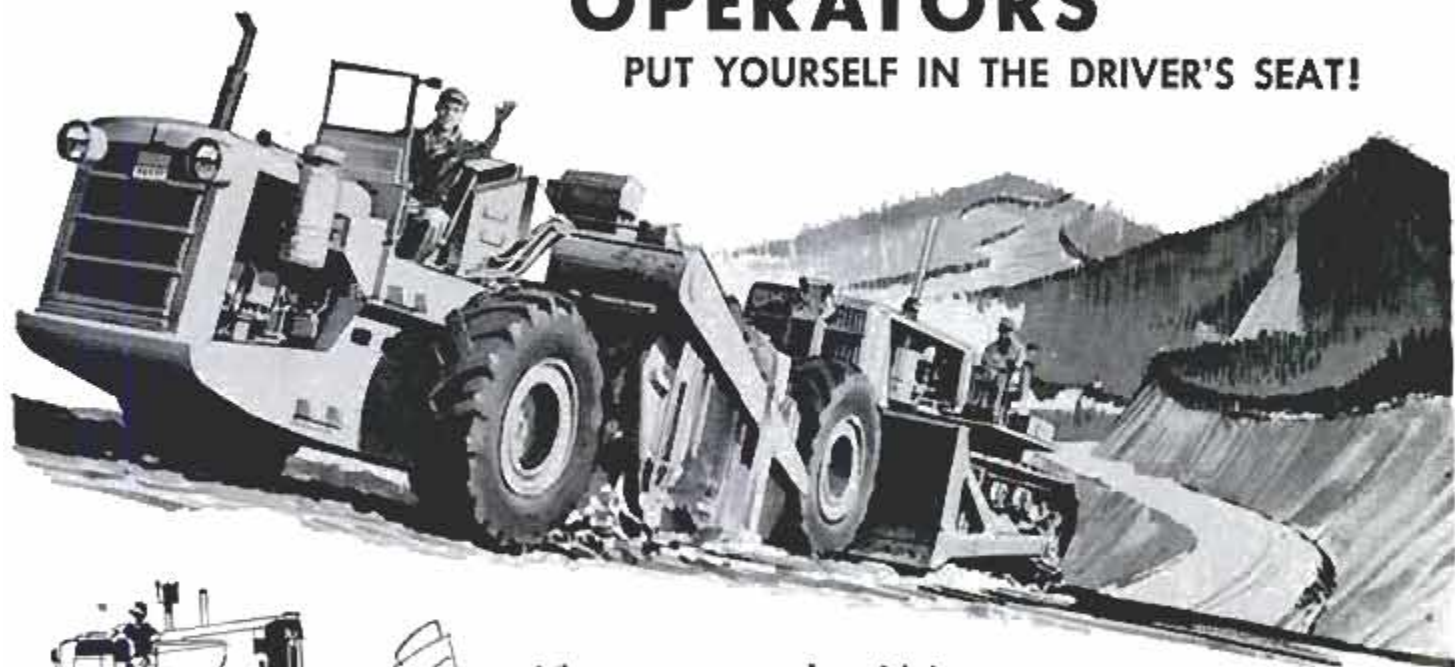
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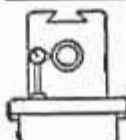
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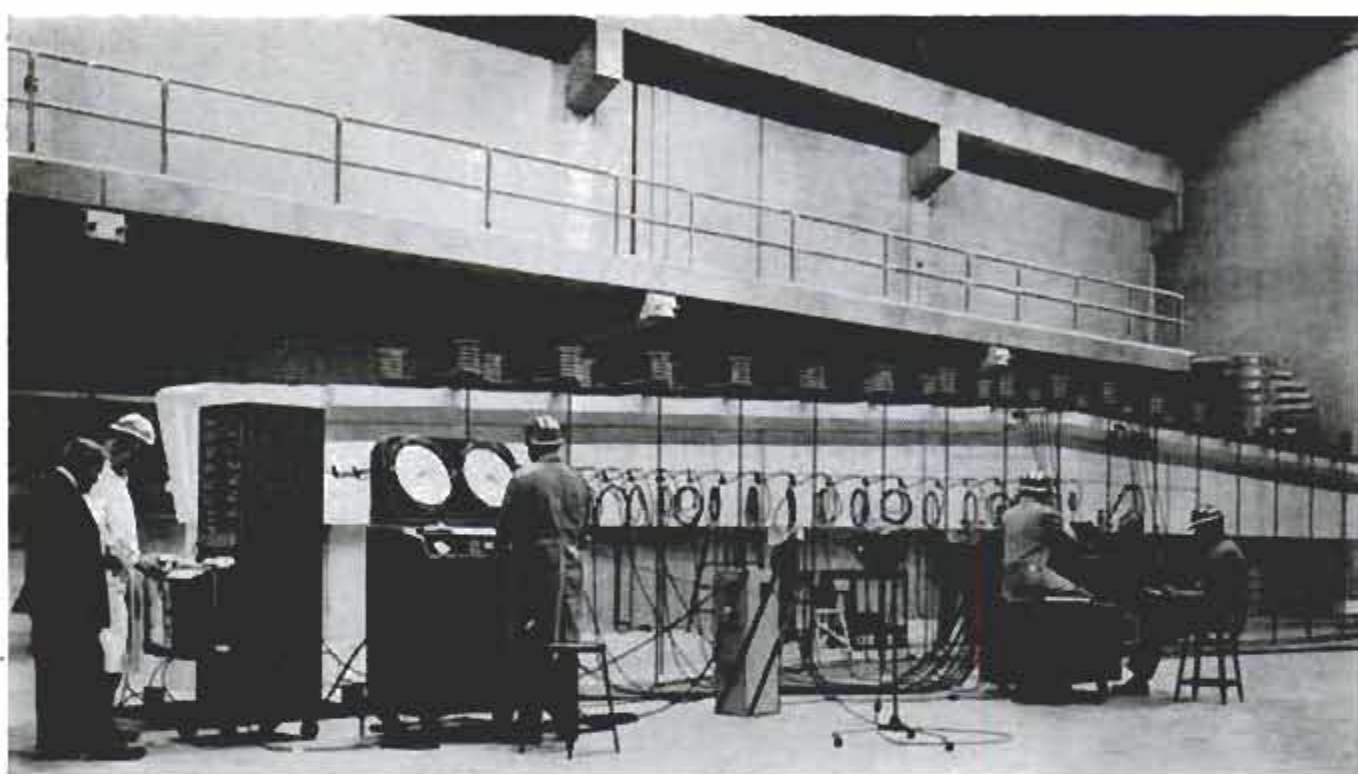
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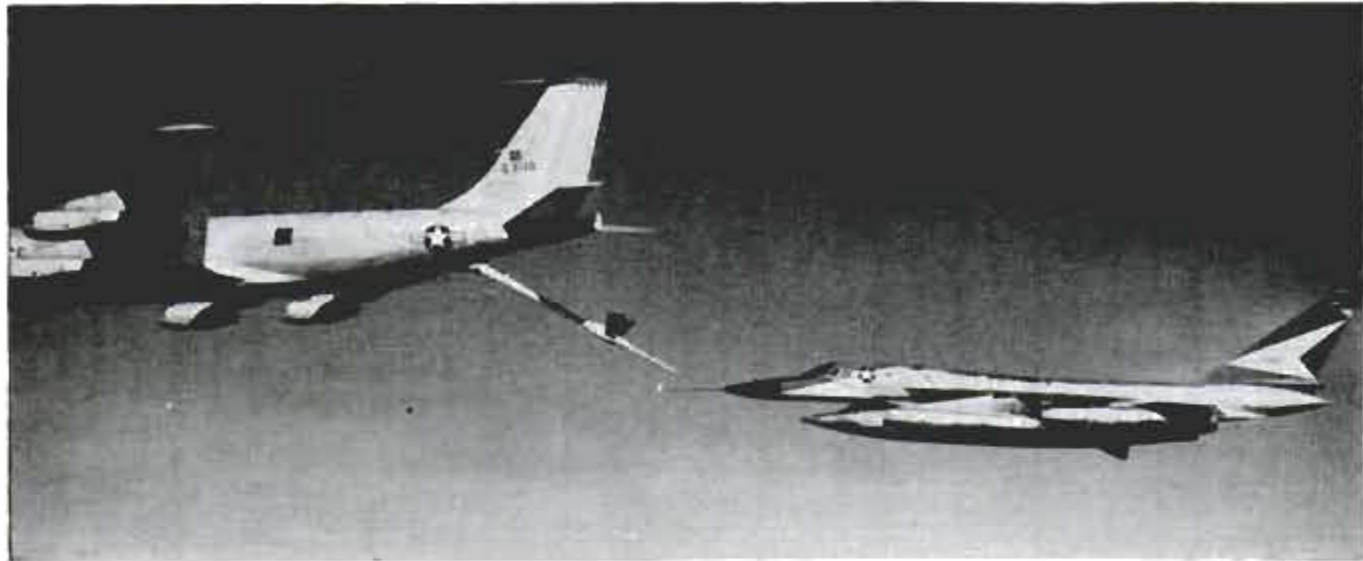
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The lives of thousands of successful men—those who have climbed out of the "rut"—show an amazingly similar pattern. They weren't satisfied—*so they made a decision*. In each man's life there was a moment—perhaps the same as this moment in yours—when he *decided to succeed*. From somewhere deep inside himself he drew an overwhelming determination. He *would* succeed. From that moment he focused all his energies in a single direction—to succeed in his chosen career.

In most cases, once he had made this all-important decision, he found that the sacrifices were small compared to the rewards. Indeed, most of these successful men found that there were no real sacrifices, that work toward their goal became

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But first they had to make the decision to succeed. Only you can make this basic decision for yourself. No one can make it for you. And it must be made without any reservations.

Sure you want to succeed. You can—if *you decide to!*

2. Once you've made this decision, only one thing remains to be done: *You must take action.*

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I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my Winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things; of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life, is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept

something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows". It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own". It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverse.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turn-

ing out a product that has a steady and ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

VICTOR B. MASON
1512 Jarvis Ave., Suite M-2-A
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EXCLUSIVE Line of personal initialed buckles, belts, cap badges, 3000 emblems. Hook-Fast, Dept. PM, Roanoke, Va.

SELL Bowling shirts with players' names, team emblems colorfully embroidered. For men, women. Entire teams, leagues buy at low prices. Make \$500 monthly extra. Sales kit free. Master, Dept. K-19, Ligonier, Indiana.

FOG—Stop windshield cloth. Instantly removes blurry mist, frost, sleet, snow. Stops windshield fogging. Samples sent on trial. Kristee, 56, Akron, Ohio.

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ANYONE Can sell famous Hoover uniforms for beauty shops, waitresses, nurses, doctors, others. All popular miracle fabrics: Nylon, dacron. Exclusive styles, top quality. Big cash income now, real future. Equipment free. Hoover, Dept. A-138, New York City 11.

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FOR Easiest extra money, get samples of 1959's fastest-selling greeting card assortments, gifts, exclusive stationery. Lovelier, bigger values, more profitable. Cash bonus, too. Big line. Samples on approval. \$1.25 gift introductory offer free. Cardinal, 1400 State, Dept. A-79, Cincinnati 14.

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FABULOUS Money makers. Fast selling dish cloths, 500 other popular articles. Lowest wholesale prices. Smiling Scot, DP3 1266 Goodale, Columbus 8, Ohio.

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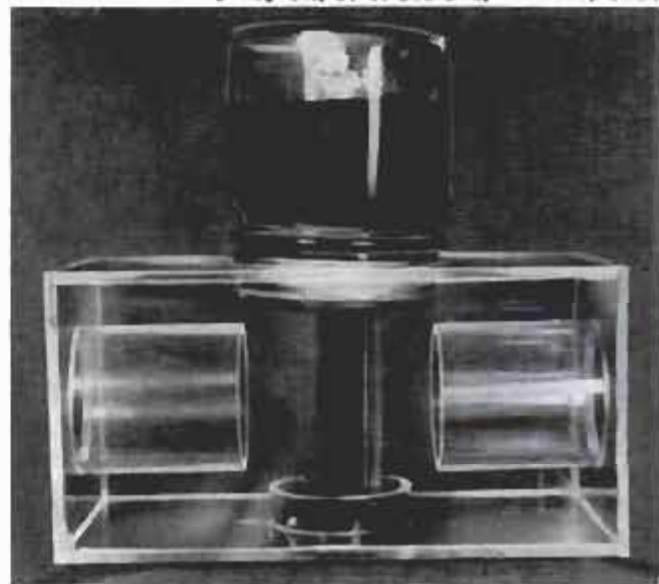
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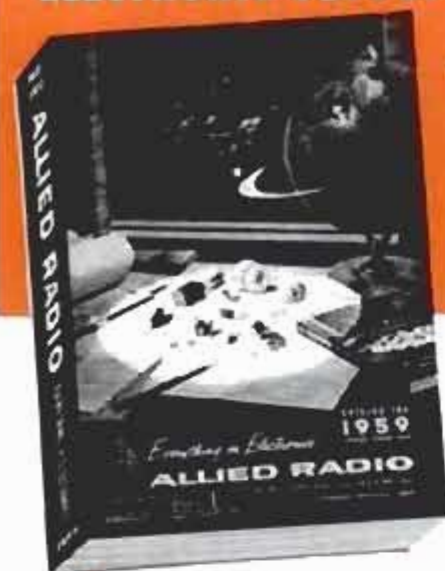
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GET HIGH PAY FASTER AS AN ENGINEER OR TECHNICIAN

In every branch of engineering—electronics, electrical, mechanical, civil, aeronautical—the demand for engineers and technicians is acute. Men with engineering qualifications command top positions in industry. They draw large salaries, have security and prestige. You can enter this high income field yourself by training at home in your spare time through

our proven home study courses.

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No previous experience is required. Start from the ABC's if necessary or at whatever point to suit your present knowledge. Each course is written by an eminent authority in his field and includes a library of standard textbooks. Step-by-step instruction methods proved successful by thousands of our graduates, lets you understand the toughest problem with ease. If you are ambitious and willing to study, send the coupon below and we will forward two booklets describing the course and the Institute's advanced teaching methods. C.I.S.T. courses are endorsed by some of North America's leading companies.

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Address

City State

Course of Interest Age

Occupation

Canadians: Send to Canadian Institute of Science & Technology Ltd., 714 Garden Bldg., 263 Adelaide St. W., Toronto, Ontario.



Foot Pressure Lifts Garage Door

Your overhead garage door can be started upward with a minimum of effort when a lifting device is attached to the bottom of the door. You simply step on the pedal and your foot pressure provides the initial lifting action. The lifter is made of aluminum and can be attached to the door in a few minutes.

Automatic Lens Unit Can Be Added to Movie Camera



Owners of eight-millimeter motion-picture cameras with "D mount" lenses can now get automatic interchangeable lens units which are activated entirely by changes in light and shade. The iris is controlled by electric energy from a selenium cell which, in turn, responds to the amount of sunlight or artificial light on the area being photographed. The lens unit can be set for use with color films in the range from ASA 10 to 16. It also can be switched to manual settings for stop-motion or slow-motion effects.

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NOTICE—It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. Except where otherwise indicated, this magazine has no information as to any unexpired patents in respect of the developments reported herein. In the event that commercial use is to be made of any of the developments reported herein, it is suggested that legal counsel be consulted to avoid liability for patent infringement. It is not the purpose of this magazine to encourage patent infringement but, as indicated, it is the intention of this magazine to report on the latest developments in the mechanical arts.

OPPORTUNITIES

A number of one-man mail order enterprises are paying their owners an income of \$40,000 to \$50,000.

special feature



Mail order is big business. Annual catalog sales volume of Sears, Roebuck and Co. is over 700 million dollars!

HOW TO START

Your Own Mail Order Business

By John Winkler

You can make a fortune by mail. New firms will set you up in a fabulous mail order business of your own! They'll make up your catalogs, prepare your advertising, supply mailing lists and even ship your products for you!

WHEN Arthur Johnson decided to earn some extra cash during his spare time he chose the mail order business because it could be run right from his own home. He reasoned that it was one of the few fields still open in which you could start your own business with a minimum of capital. In fact, his total investment was less than \$100.00.



Witness the success of Arthur Johnson. He obtained a franchise from Mail Order Associates and within three months the profits started pouring in.

What began as a spare time job mushroomed into a profitable full-time business.

How successful was Johnson? Well, he drives a Cadillac convertible, owns a home in Nevada and a summer place in Florida, with a Cris-Craft cruiser to boot!

No, Johnson didn't find Uranium or answer the \$64,000 question. He simply cashed in on the fabulous mail order business — with the help of one of the new mail order organizations which back enterprising new comers to the mail order business.

Like so many other beginners in this field, Johnson was plagued with the problem of finding the 'ideal' mail order product. One that would have a large market, offer a good profit margin, bring repeat sales, and one which could be easily shipped by mail. After reading several books and courses on the subject, it seemed impossible. In order to obtain wholesale prices from manufacturers he had to purchase large quantities, which meant all his capital would be spent in inventory. The additional cost of sales letters and advertising and the risk of picking a poor mail order product and being stuck with all that merchandise made it even more obvious he'd have little chance of success.

Then he heard about Mail Order Associates of Maywood, New Jersey — an organization set up to aid the small mail order operator.

He wrote to M.O.A. for full information, sent in his application for a franchise and within three months the profits started pouring in.

Johnson attributes his success to the large selection of novel and unusual mail order products carried by M.O.A.

Mail Order Associates is one of the few new pioneers in the fabulous mail order business. One of the first organizations formed to put the small mail order operator in business—big business, they fill a definite need for the beginner with little capital. Here's what they offer you:

(1) Complete, ready-to-mail catalogs printed with your name and address . . . in any quantity you wish. Catalogs, sales letters or self mailers may be based on any of the following typical categories:

BABY GIFTS AND NOVELTIES

VITAMINS

**INSTRUCTION BOOKLETS AND COURSES
COSMETICS**

You select your own market.

(2) Profits range from 50% to 150% on most items. For example, you may sell a \$20.00 mail order course and make \$10.00 on each sale. Or you sell two appliances at a discount, give one away free and still make a 50% overall profit!

(3) Everything is drop-shipped for you. You have no merchandise to carry—no capital tied up in inventory. All merchandise is stocked and shipped for you by Mail Order Associates or the manufacturer. You forward orders and your own shipping labels to M.O.A. and all merchandise is sent direct to your customer — using **YOUR OWN LABEL**.

(4) Up to date mailing lists are made available to you. Lists of proven mail order buyers are compiled for the market you select. Records are kept so that no two distributors use the same names. All names are supplied on gummed labels — all you do is apply them to your catalogs.

(5) A consultation service is provided to answer any questions you may have. In addition, you're supplied with a list of leading national magazines that provide free editorial write-ups. You're even given form letters to use to obtain free advertising of your products from these magazines.

(6) Your choice of at least four new mail order programs during the year. One may be a catalog of baby items, another on household gadgets, etc. You may select one or as many as you can handle.

Here's how they operate: Unlike the individual mail order dealer who looks for the ideal product, M.O.A. searches the market first! After making surveys and tests to determine a profitable mail order market, they select the products to suit the market. For example, the market of selling baby items to new mothers is a big one. Over four million babies are born in the U. S. each year. This is the first step in selecting a mass market for their franchised dealers. Then comes the selection of products to suit this market. They contact every manufacturer of products sold to new mothers. From thousands of items offered by various companies, only those suit-

able for mail order are selected for preliminary tests. The final survey is made for new novelties and products not yet manufactured! If they feel certain ideas for new products have merit, they'll manufacture the items on a royalty basis and produce them for their dealers exclusively!

From this preliminary selection of new mail order products suited to this particular market, they make actual tests to see which items will sell and produce the greatest profit for their



The thrill of receiving money in your morning mail is one you'll never tire of.

franchised dealers. Having finally selected the best products they begin layout and artwork on a new mail order catalog for their dealers. The final catalog may consist of a small 6 x 9 brochure, a large 8½ x 11 illustrated booklet or even a small one page self-mailer, depending upon the market and selection of products. Sales letters are prepared by experienced copy writers, and the complete job—layout, copy and printing is done by experts to produce professional results.

By purchasing merchandise in large quantities and running catalogs on large presses, they are able to offer their dealers complete backing at a fraction of the cost the individual would have to pay for the same job.

The final step is to supply the franchised dealers with names of prospective customers! In this particular example, they would make available the names and addresses of over 7000 new mothers every day!

Although many mail order firms use magazines and newspapers to advertise single items, the larger established firms have proven that direct mailings to prospective customers and previous mail order buyers is far more profitable.

A notice is then sent to all franchise holders explaining in detail the complete sales program for the particular market covered. The dealers then have the option to accept the offer or wait for a complete new sales program set up for a new market. At least four complete new sales programs are prepared by Mail Order Associates each year.

If the dealer decides to go ahead he may begin ordering catalogs (his personal name or business name is printed on all sales literature), and mailing them to his lists of prospective customers. As he receives orders for merchandise he simply forwards the orders together with addressed shipping labels to M.O.A. and they fill the orders and mail direct to his customers with the dealer's shipping label attached to each parcel. In some cases M.O.A. prepares a catalog of merchandise which manufacturers have agreed to drop-ship for the dealer. Mail Order Associates simply turns over this list of firms to the dealer and he works directly with the manufacturer. The customer pays the dealer the retail price of each item in the catalog. The dealer in turn pays M.O.A. or the manufacturer only the wholesale price of each item and pockets the difference—which really adds up when you mail a few hundred catalogs a week.

The operation of Mail Order Associates is based on a small margin or profit, but tremendous volume, which spells BIG PROFITS FOR ITS FRANCHISED DEALERS.

Mail Order, however, just as any other business, does involve a certain amount of risk. But the initial investment required is relatively small (\$80-\$100) compared to other businesses. By eliminating the initial cost of stocking merchandise and preparing expensive catalogs, M.O.A. dealers can keep their initial investment to a bare minimum. On the other hand, few other occupations offer such exceptional income potential as a small specialized Mail Order business. The important thing to remember is that in Mail Order like everything else, the person who works hard and is not easily discouraged has a good chance of succeeding.



Big firms will carry all stock for you. They ship orders direct to your customers using your own shipping labels.

Your OWN Catalogs of Top Mail Order Items!



Mail Order Associates will prepare your catalogs, write your sales letters, supply mailing lists and even ship merchandise for you, using your own shipping labels!

We don't say you'll be a mail order millionaire or another Sears & Roebuck, but if you're looking for a business of your own with a potential income of \$50,000 per year the answer is mail order.

MAIL ORDER ASSOCIATES

Gilbert Turk, founder of Mail Order Associates, is certainly well qualified to head such an organization. Formerly president of two large mail order companies, his articles on selling by mail have appeared in national magazines throughout the country. He has sold everything from build-it-yourself plans to name brand appliances. When the paint-by-numbers fad was

sweeping the country, he invented a three dimensional paint set which sold like wildfire. With Turk, Mail Order is almost an obsession. He thinks, talks and lives it.

Firmly convinced that no other business offers the tremendous opportunities of mail order he is an outspoken advocate of the man or woman who wants to start in business for himself. As Turk puts it, "By all means, start your own business and start TODAY! If you want security, independence and a chance to hit the jackpot, make your choice Mail Order. There's nothing like it. Absolutely nothing!"

FOR FREE DETAILS

Mail coupon below today

Mr. Gilbert Turk, Pres.
MAIL ORDER ASSOCIATES
Dept. PM-84, 130 W. Pleasant Ave., Maywood 84, N. J.

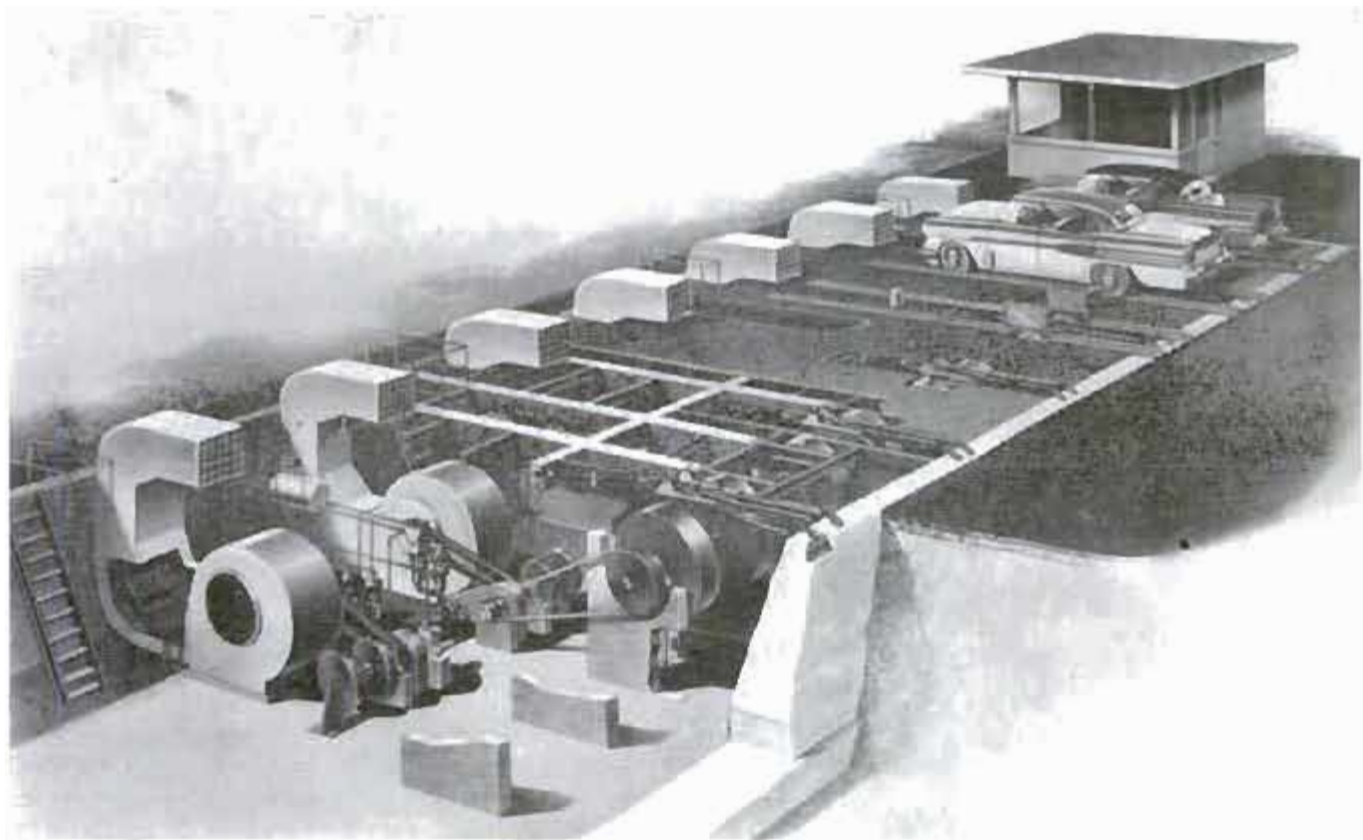
Dear Mr. Turk:

The co-operative dealer franchise plan with Mail Order Associates sounds exactly like the kind of lifetime business of my own I want to establish. Please send me complete FREE details on how I can get my own franchised dealership.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



One Man "Road Tests" Eight Cars at a Time on Treadmill

IT TAKES ONLY ONE MAN sitting in a control room to run realistic "road tests" of as many as eight cars at a time at the Esso Research Center in Linden, N. Y. Magnetic tape recordings control the operation of cars and can be recorded for any type of driving desired. The recordings are made on actual road tests and then played back to control the cars on the treadmill.

The rear wheels of the cars rotate rollers which, in turn, spin huge blowers that provide the load for the tests and also provide cooling air across the radiators. Incidentally, the road tests reveal that rock-and-roll music on a car radio can reduce gasoline mileage as the driver unconsciously jiggles his foot to the music's rhythm.

...





NEW PERFECT CIRCLE ROAD TEST SIMULATOR... another first in power protection for your car!

Remarkable Perfect Circle development tape-records actual road test, electronically duplicates exact engine operation on the test stand!

Perfect Circle's new Road Test Simulator records hours of test driving over all kinds of roads in all kinds of weather and reproduces the test right in the engine test lab...electronically.

Weeks of testing are accomplished in days to speed engine improvements and give you the very best piston rings obtainable—Perfect Circles!

Other Perfect Circle firsts include famous PC 2-in-1 Chrome piston

ring sets. Top rings and oil rings are plated with thick, solid chrome. Entire area of ring travel gets complete wear protection, *more than doubling* life of cylinders, rings, and pistons. No tedious break-in is necessary—rings are pre-seated at factory.



New Perfect Circle Valve Seals stop oil loss through valve guides of overhead valve engines. For best performance, valve or ring jobs should include installation of Perfect Circle Valve Seals. The cost is surprisingly low.



**For full power protection
insist on Perfect Circles!**

PERFECT

Hagerstown, Indiana



CIRCLE

Don Mills, Ontario, Canada

2

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 111 NO. 1

1

3

4

5

6

Key points in Seaway include: 1. Wiley-Dondero Canal, with Eisenhower Lock above it and Snell Lock below; 2. Long Sault Dam; 3. Barnhart Island; 4. Robert H. Saunders-St. Lawrence Generating Station (the Canadian half) and the Robert Moses Power Dam (the United States half); 5. Cornwall, Ont., 6. old Cornwall Canal

Photo courtesy Power Authority of State of New York

STAIRWAY to the SEA

*Reprinted
"PM Highlights"*

This is the year that the St. Lawrence Seaway opens its gates to let ocean liners and freighters sail the lakes—an epochal feat of engineering and of international cooperation

By Richard F. Dempewolff

FOR THE PAST FOUR YEARS, a Canadian-American army of mud-begrimed men in hard hats, numbering at times up to 22,000, has been digging a king-size ditch. To the clatter of jackhammers, the rumble of more than 150 giant shovels and draglines, and the roar of an endless stream of earthmovers, they have ground deep into

the ancient bedrock beneath a brawling 180-mile section of the St. Lawrence River. Behind miles of protective dikes and cofferdams, their clanking steel monsters have gouged out footings for a string of big dams, massive concrete locks and many super powerplants.

In early spring, when the last of the mud



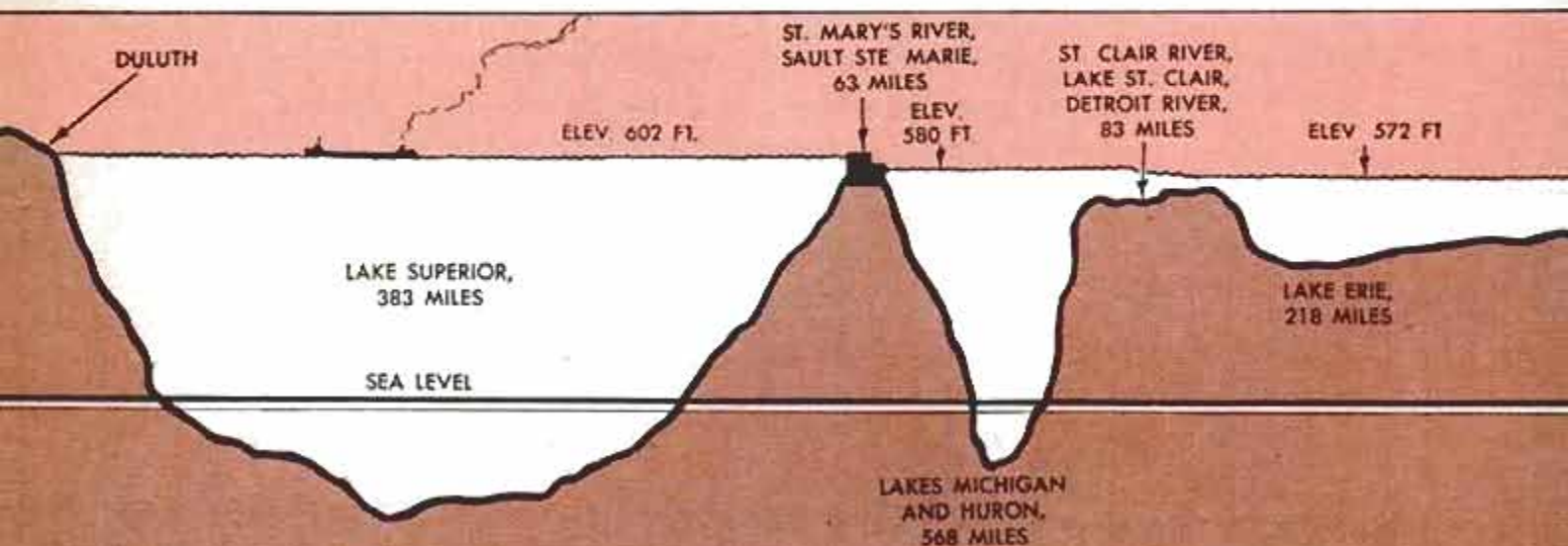
Lake steamer leaves Eisenhower Lock and moves on its way to Snell Lock, about three miles downstream

has settled in the miles of canyonlike channels they have carved, and the last raw earth embankment has healed under a new hide of turf, the St. Lawrence Seaway will have become a Gargantuan \$1,090,000,000 reality.

Unlike the 50-mile Panama Canal and the 100-mile Suez, the world's third great

inland seaway (built jointly by the United States and Canada) is a two-fisted giant. The mighty dams that back up its rapids into usable waterways also harness the once-wild river, steering it through batteries of sluice gates in two big power dams. One of these is second only to Grand Coulee. From its rumbling generators,

Cross-section of the Seaway from Lake Superior to the Atlantic Ocean shows relative location of the locks.





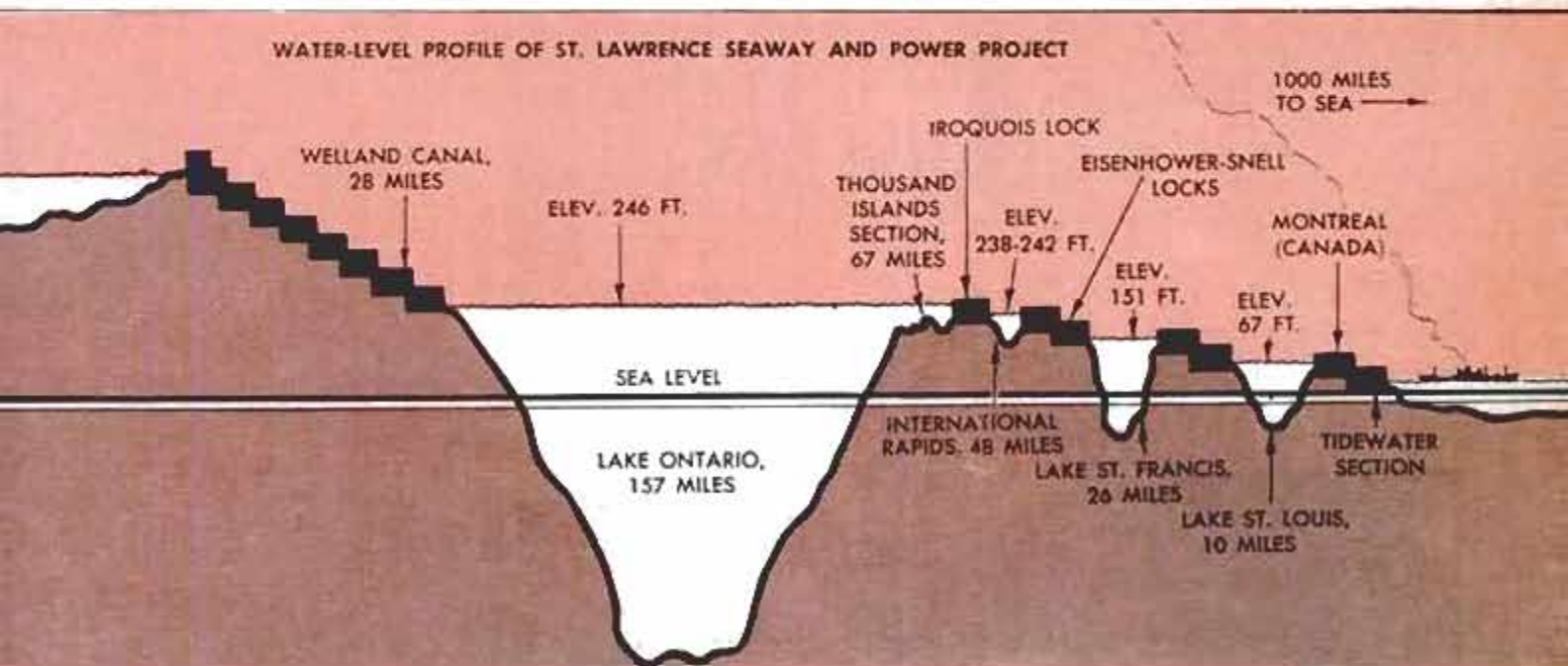
Controls for lock valves and gates are on console. Warning lights prevent operator from making mistakes

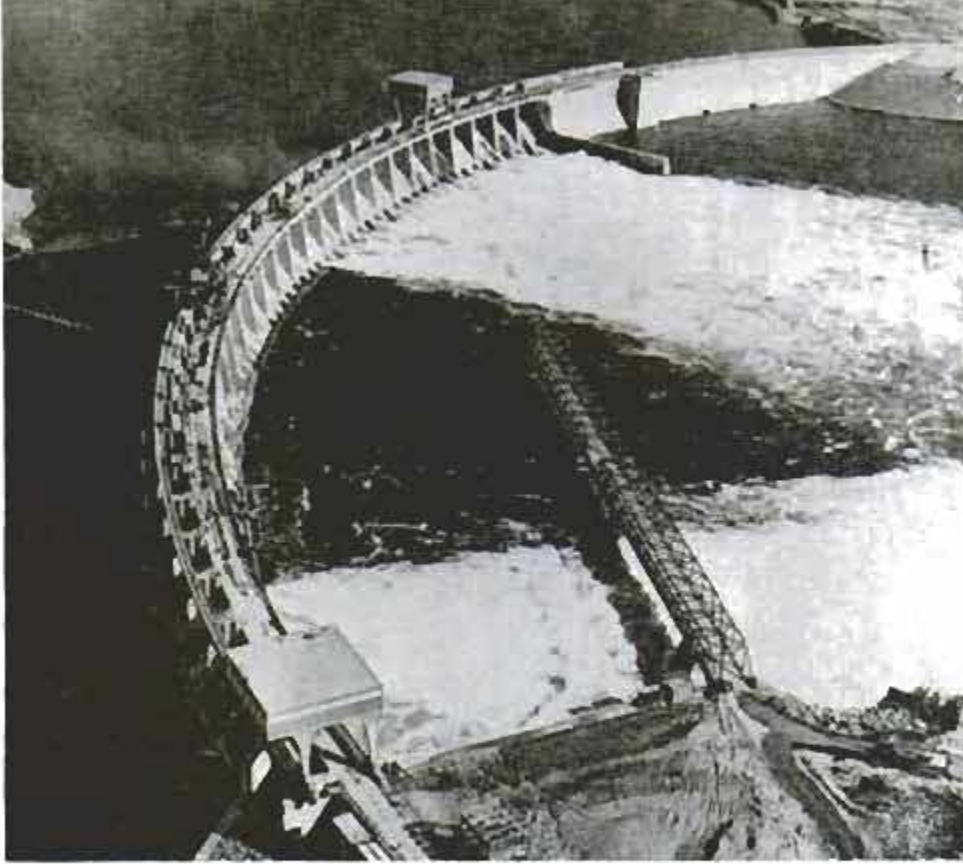
1,800,000 kilowatts of electricity will be fed into the power grids of Canada and the United States.

No less dramatic in its implications is the waterway created by the great dams. For the first time, deep-draft ocean ships will be able to sail 2370 miles from the Atlantic to the heart of North America. Midwest-

ern cities fringing the Great Lakes' 8300 miles of shoreline will become true sea-ports. Cities like Chicago, Duluth, Milwaukee, Detroit, Cleveland and Toronto are destined to become world ports. You may climb aboard a passenger liner at Chicago, and sail to Liverpool, Bremerhaven, Cherbourg, Singapore — or where

Water level drops more than 600 feet, most of it within the 360 miles between Lake Erie and Montreal





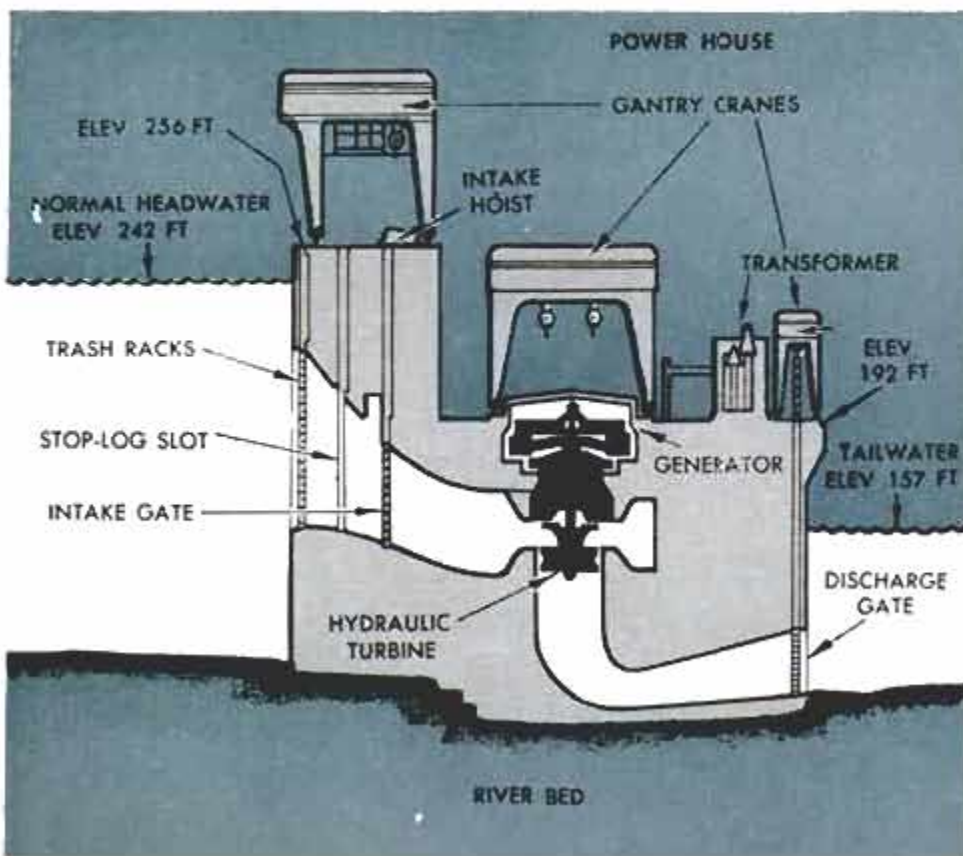
Water roars from both sides of nearly completed Long Sault Dam. Bridge downstream was used by earth-movers to reach a cofferdam during construction. The bridge will be removed later

you will. The Dutch-owned Fjell-Orange Line already has launched one passenger-cargo liner, with accommodations for 110, for the Great Lakes trade. Another is on the ways. Fare? About \$180 to Europe one way, they say.

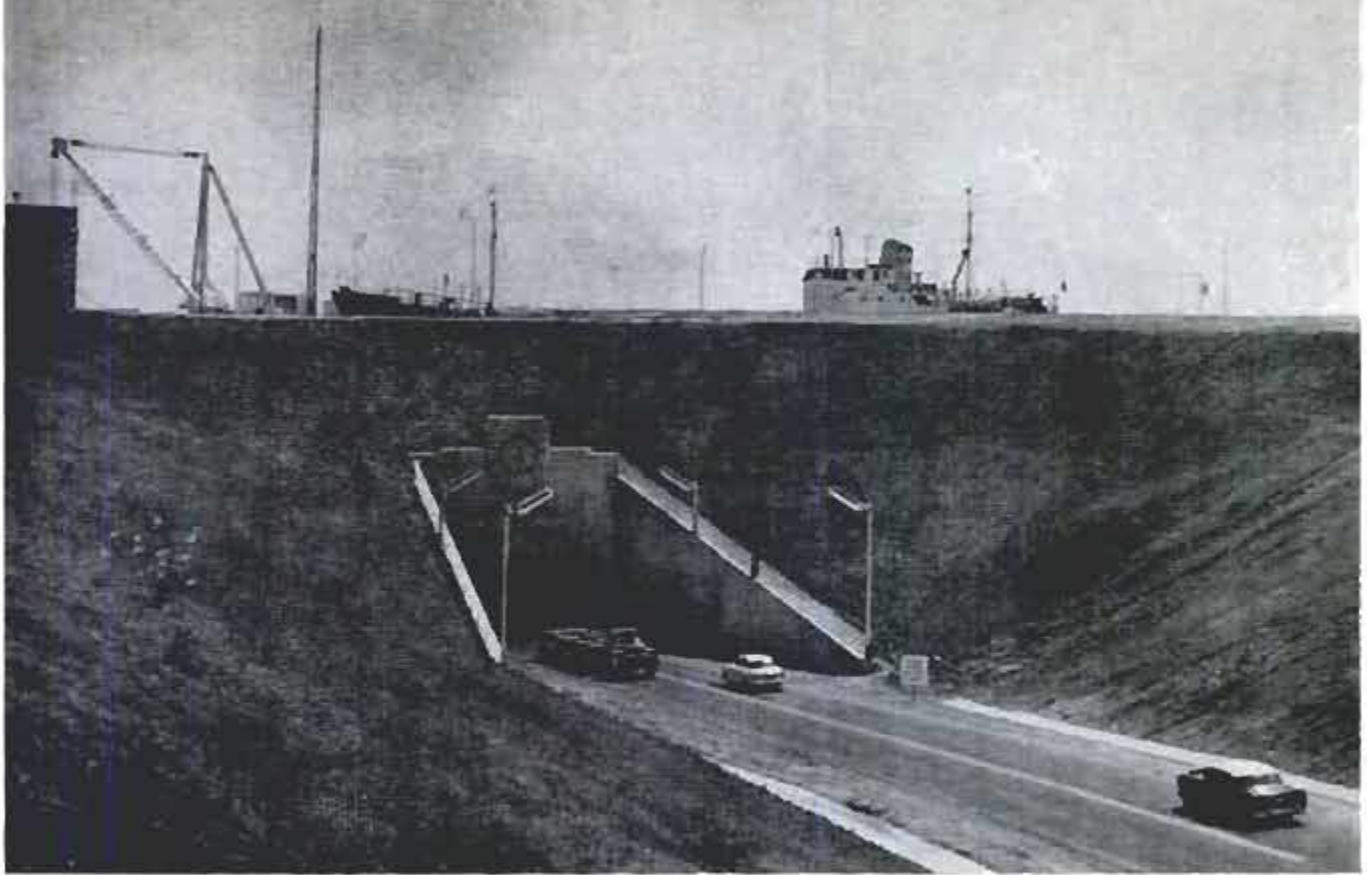
You get some inkling of the staggering size of this project when you realize that the engineers had to devise a way to lift an ocean liner the height of a 60-story skyscraper, for Lake Superior sits 602 feet above the Atlantic. The St. Lawrence River and its Great Lakes headwaters, draining a land mass greater than Britain and

France, make this drop in a series of steps like the cascading water in a tiered fountain. What the Seaway does is climb over those tiers on a series of great locks—huge “stairs” with water for treads.

Coming in from the Atlantic, a ship will steam up the broad Gulf of St. Lawrence and into the narrowing river as far as Montreal. Two miles below the Jacques Cartier bridge, the skipper will nudge his bow into a broad channel on the north side of the river. Massive 35-ton miter gates will yawn to admit his vessel into St. Lambert and Cote St. Catherine Locks—first



Cross-section of a Seaway generating station shows how water rushing from intake gate spins hydraulic turbine connected to generator. The gantry cranes are used to raise or lower gates



Vehicular tunnel permits trucks and cars to drive beneath ships at Eisenhower Lock on Wiley-Dondero Canal

two steps in the giant staircase. Like all the steps in the new waterway, these locks measure 800 feet long, 80 feet wide, with 30 feet of water over the sills. Allowing minimum clearance, a ship 768 feet long, 75 feet abeam and drawing 27 feet of water can squeeze in.

In two 25-foot leaps the ship will clear Lachine Rapids. Sailing up a broad pool in the river called Lake St. Louis, the ship moves westward toward Beauharnois

Locks, which hoist the vessel 84 feet to the level of a broad canal, carved in solid rock, that feeds Beauharnois Power Dam. On this pond, the ship glides into another broad stretch of river—Lake St. Francis. Up to this point, the new system is entirely Canadian-built.

Fifty miles upstream the ship signals for clearance at the Bertrand H. Snell and Dwight D. Eisenhower Locks, on the American side. These two hydraulic elevators

Huge turbine runner assembly for one of the dam's generators is moved into lowering position by gantry
Photo courtesy Power Authority of State of New York



Riding the top of power dam like giant four-legged stool is gantry crane that lifts and lowers gates





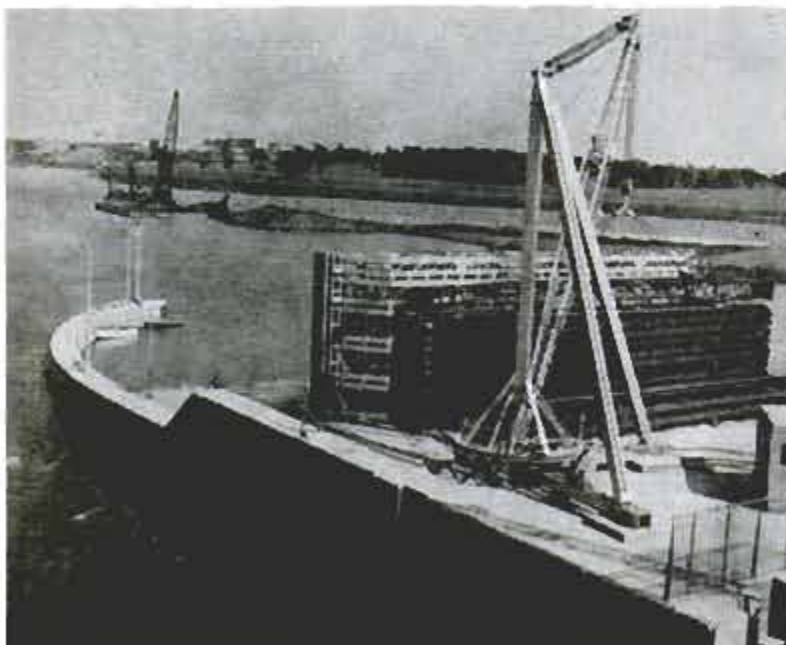
Innovation in the locks are mooring posts that slide up and down in slots in wall as water level changes

perform a 90-foot lift previously accomplished by 11 separate locks between the foot of International Rapids and the town of Iroquois, on the old Cornwall Canal that once accommodated small lake steamers. The old canals, locks and even the rapids themselves, lie deep under the placid water of a new lake, formed by water backed up behind mountainous piles of concrete—Long Sault Control Dam and Robert H. Saunders-St. Lawrence Generating Station

and Robert Moses Power Dam. These bulwarks, built through the combined efforts of New York State and Ontario Province, form the heart of the international seaway power giant. Between them they pile up a placid navigation pool for nearly 40 miles upstream, and use the 81 to 90-foot head thus created to spin the giant generators.

At the western end of this pool, another Canadian lock lifts the ship five more feet to Ontario-level waters behind Iroquois Dam, which controls the flow of water into the great power pool.

Ready crane at each portal would drop steel stop-logs on each side of the channel to stop water flow if gates were damaged



Across Lake Ontario comes the spectacular 327-foot heave. This is accomplished in Canada's 28-mile Welland Canal, bypassing the Niagara River with its falls and gorge. Four single locks, a flight of three double locks and one guard lock do the job. Opened in 1932 to replace a century-old 14-foot-deep canal, the present locks and channels have been deepened to conform with the new Seaway specifications.

Once atop the Welland, a ship has navigated all of the official Seaway. The Soo Locks, providing the final lift into Lake Superior at Sault Ste. Marie, form the top step in the long stairway. But all through the Great Lakes big

(Continued to page 270)



"Venetian Blind" Reduces Jet Noise With High-Pressure Water

Jet-engine noise can be suppressed by a "Venetian blind" unit that turns the plane's heat blast into steam. Placed 12 feet behind the jet's exhaust, the apparatus absorbs

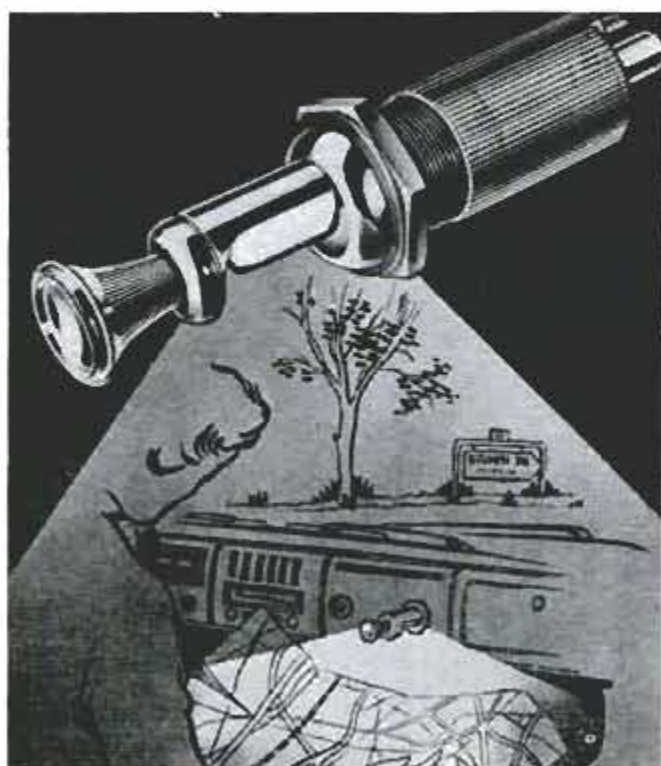
the blast by ejecting high-pressure water through the first set of blinds. A second set deflects the reduced blast upward to final dissipation on a ramp.

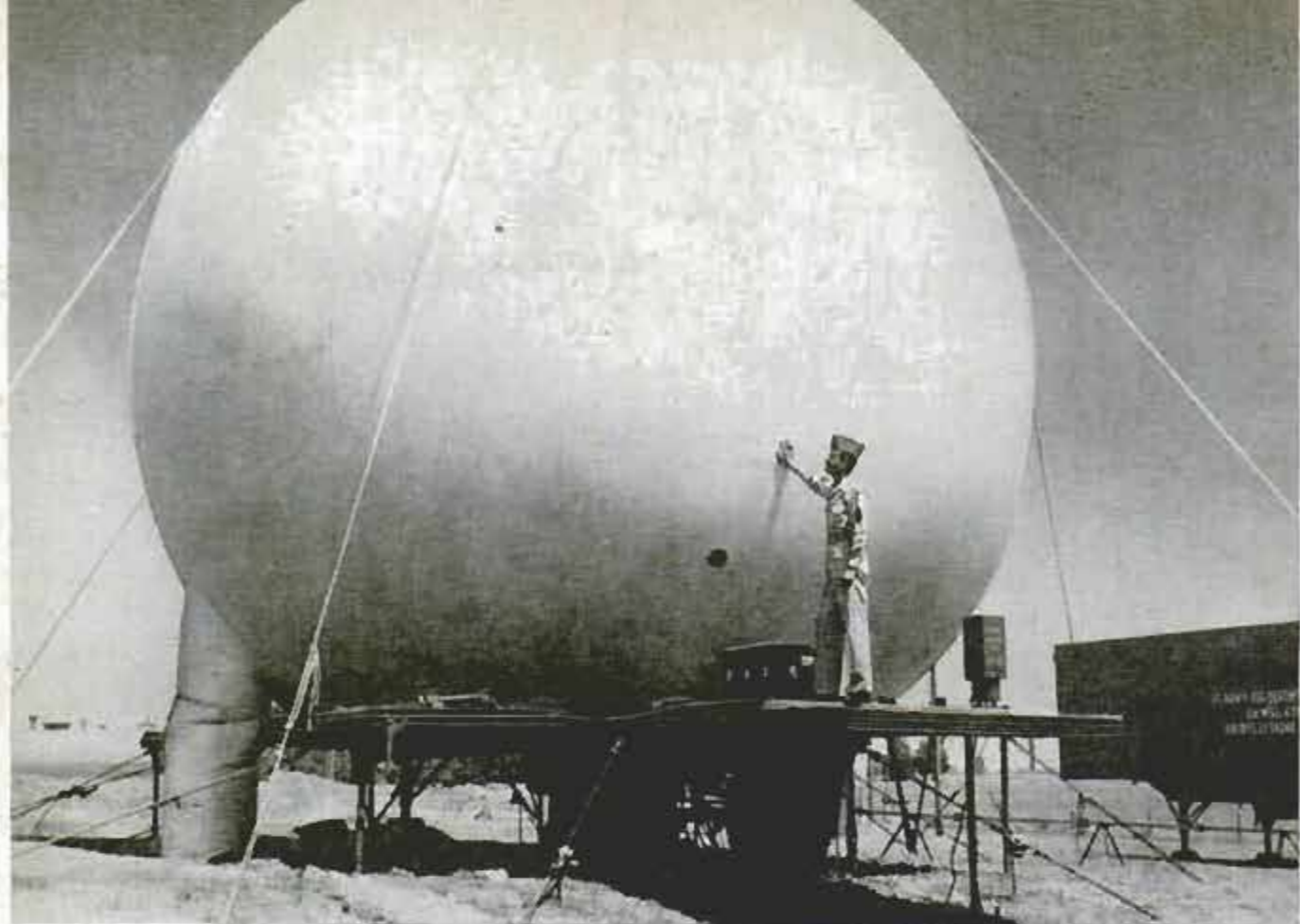
Telescoping Dash Light Handy for Map Reading

Designed to blend with other dashboard devices is a telescoping light that can be pulled out for map reading. The lamp can be turned all the way around if it's needed to locate the ignition or to light the step. It fits in a one-inch dashboard opening.

Clothes-Drying Rack Hangs Over Bathtub

By hanging a wire rack directly over the tub, clothes can be dried in the bathroom without dripping water on the floor. When not in use, the rack can be unhooked from the uppermost fastener and lowered against the wall.





'Balloon' Houses 3-D Radar

AIRBORNE TARGETS are pinpointed as to distance, bearing and altitude by a new 3-D radar. Conventional radar systems yield no information on altitude. The new system, developed by Hughes Aircraft Company, can be moved in one equipment van, one power truck and an antenna trailer. At the radar site, air blowers are used to inflate a radome of rubberized nylon around the antenna. The dome, under slight air pressure, protects the antenna from wind, snow and ice. The information from the radar is displayed on two scopes; one gives target range and bearing, the other altitude. The information, in digital form, is fed to missiles for interception of targets.



PART II

IN ALL THE history of hocus pocus, no magician created greater turmoil than Houdini, master showman, when he made an elephant vanish at a pistol shot.

Houdini debuted with this illusion on the stage of the New York Hippodrome in 1918. A huge elephant was led up an incline and into a large cabinet. The open front of the box then was closed. The box was swung around on heavy wheels. Houdini fired a pistol. Presto—the box was empty!

At first, many thought a trap



Author Christopher places open box over Gary Moore's head

I Call These ...
**THE
GREATEST
MAGIC
ILLUSIONS
OF ALL
TIME**



Closing box, Christopher stabs knives into it from several angles, then opens box to show that Moore's head has vanished

door was used. That is, they thought so until they were reminded that directly under the stage was the huge water-filled tank which the theater used for bathing-ballet numbers. Besides, the box was raised off the floor.

The vanishing elephant was a masterpiece of stage magic, and will live in the annals of hocus pocus as long as magic survives.

The scientific secrets of illusions are zealously protected. The basic appeal of magic is mystery. Once the mystery is gone, there is no magic. By keeping their secrets hidden, wizards not only protect



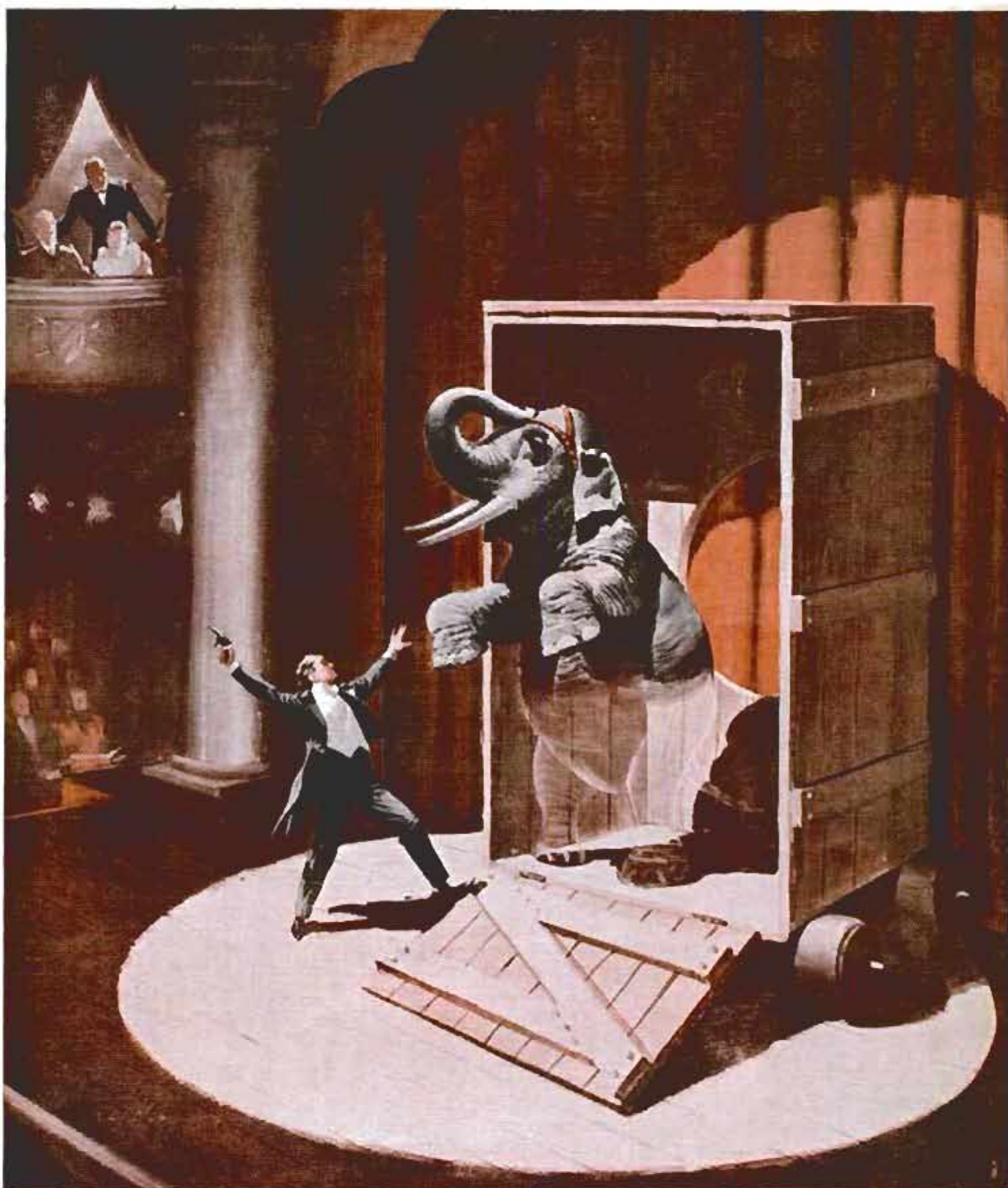


Charles Morritt would display an empty cabinet, then produce an entire fox hunt in full view of the audience

their huge investments, but more important, keep magic alive as a diverting entertainment.

A prime example of such entertainment was offered more than 100 years ago when Robert-Houdin, the French innovator, baffled continental theatergoers with his "Suspension Ethereneene." Ether was then a mysterious new liquid. Robert-Houdin

uncorked a bottle under his son's nose. Fumes seeped through the audience. The wizard announced ether would make a body lighter than air. The boy fell asleep. Rods supported him under his armpits, and a stool kept his feet above the stage. The stool was removed. Then one of the rods was taken away. The boy remained suspended by a single slender rod under his



Houdini originated the most famous of all illusions, making a huge elephant disappear at a pistol shot

arm. He was lifted until his body was horizontal. Only his elbow touched the rod. Still he remained suspended. The illusion was a sensation.

When the properties of ether became better known, performers omitted it from their presentations. And after suspensions lost their novelty, it was inevitable that illusionists would cause their assistants to

float up, down and around the stage. John Nevil Maskelyne created a master method. Harry Kellar, the American, improved it. In his version of levitation, a hypnotized subject rose slowly from her couch at the wizard's command.

"Ah," thought many spectators, "wires or glass panels." But Kellar calmly passed a solid hoop over the floating body, then

tossed it down to the audience for examination.

Thurston, Kellar's successor, heard people say, "If only I could get closer to the floating girl, I'd discover the secret." He invited 20 or 30 spectators to come to the stage and watch her ascend from a few feet away. They were the most baffled people in the theater!

Large-scale sorcery is expensive to produce. Thurston told me that he spent \$50,000 to perfect the levitation. To the audience, there was no evidence of lifting power other than his words and the gestures of his expressive hands.

One of the greatest of the now-you-see-it, now-you-don't illusions was created by William Robinson, better known to the public as the Chinese magician, Chung Ling Soo.

A chair was suspended by two ropes from the top of a framework. A securely tied assistant sat in the chair. At a signal from the wizard the chair dropped to the stage—empty!

Charles Morritt, an Englishman, offered one of the most fantastic and colorful creations of all time. It was called "Tally Ho!" First he displayed a giant empty cabinet. It remained in full view on the stage. Then he fired a shot. Tally ho! To the stirring music, the production began. A fox darted from the box, followed by a pack of barking dogs, several huntsmen and a girl in riding habit on horseback. This incredible production of a complete fox hunt drew thunderous applause.

The Great LaFayette, a versatile quick-change artist, had one of the most elaborate productions ever staged, with magnificent scenery, his own musicians, a corps of assistants, dogs, horses and a lion. His greatest illusion was a playlet entitled "The Lion's Bride." A captured princess was thrown into a cage with a live lion as the action reached its peak. The lion crouched to spring. Timid onlookers shut their eyes. Suddenly, what was once a lion was now LaFayette, the conquering hero of the drama!

Horace Goldin made an illusion from the time-honored trick of rings in a nest of boxes. In the old trick, the wizard borrowed finger rings, loaded them into a pistol, and fired them at a box hanging at the side of the stage. When the boxes were opened, the rings turned up in the innermost container. Goldin used large, suspended boxes and added eye appeal with a girl instead of finger rings. He fired her



from a huge cannon. The climax came of course, when the girl was found deep inside the nest of boxes.

Perhaps the most frequently performed illusion in the world today is what is generally called the "Substitution Trunk." Houdini called his effect "Metamorphosis." The magician's assistant is handcuffed, then tied in a sack. The sack is locked in an examined trunk and tied with ropes. A cabinet is put around the trunk for a moment. The magician dashes inside the cabinet. In a split second the assistant dashes out. The cabinet is taken away. The ropes are untied, the trunk unlocked, the sack opened—and inside, securely handcuffed, is the magician. Top that one!

Boy Becomes Bathing Beauty

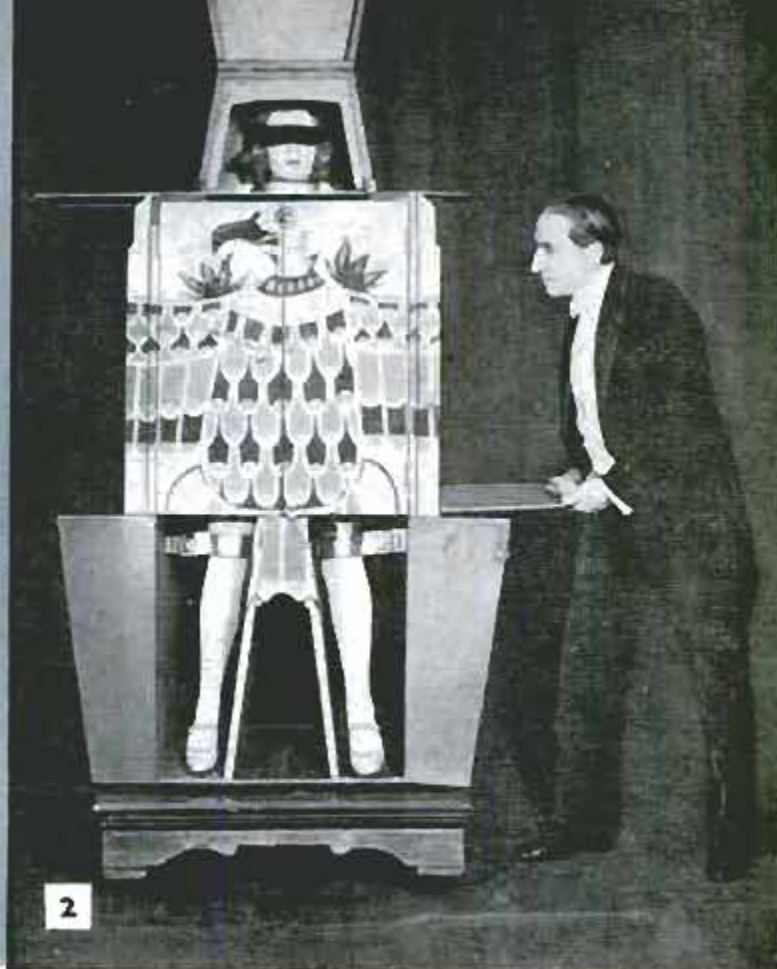
Steve Shepard, a California conjurer, has topped it with his latest illusion for water shows. A boy in a bathing suit is tied securely and locked in a trunk. The trunk is lowered into the water. After a brief, suspenseful wait, the trunk is hauled out. Has something gone wrong? The trunk is opened. The boy has vanished. Out pops a bathing beauty!

But what about that most discussed illusion of all time, "The Indian Rope Trick"? Here are the facts. An Arabian sheik, Abu Abdullah Mohammed, is the first known writer to describe it. He said he saw it performed about 1355 in Hangchau, China—not India. He said it was performed

1. One of the most famous of illusionists was Thurston, who presented an elaborate stage show. One of his illusions was a variation on the old mystery of slicing a girl in half. At left, blindfolded assistant is shackled to the sides of the cabinet

2. Thurston closes cabinet doors over center section of the girl's body. He then produces very thin metal plates, which he shows are made in one piece with no possibility of sliding sections. He inserts the plates to slice girl at her neck and knees

3. When Thurston opens the cabinet doors to prove that girl's body has been sliced, the audience discovers that her torso has completely vanished. Two assistants reach out through cabinet to demonstrate that the girl's body just isn't there any more



with a leather thong—not a rope. In his story, the boy climbed the thong to disappear from sight, and the wizard went up after him with a sword. Soon pieces of the boy's body fell from above. The wizard slid back into view. He gathered up the scattered anatomy and gave it a kick. Lo, the boy was whole again!

So, contrary to public opinion, the Indian Rope Trick isn't Indian. It isn't done with a rope. It isn't a trick, but an illusion. And the boy doesn't disappear.

Many wizards worked out stage versions, but to date, no magician has done it in the open air, away from trees or buildings.

Though the Indian Rope Trick may intrigue most people, the illusion that hopelessly fascinates me was advertised by a Mr. Ingleby in Birmingham, England, in 1806. I have the original handbill in front of me as I write:

"He will take two new-laid Eggs, the Whole of the Company may examine them, and any Person in the Room may break them, and a Child shall come out of one, and a Set of Bed Linen out of the other."

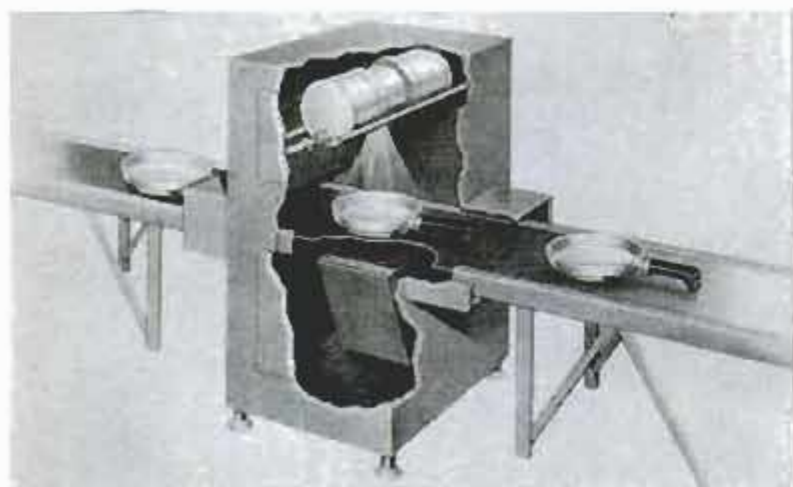
Matter of fact, Mr. Ingleby could skip the bed linen and I'd still give him the crown! ★ ★ ★



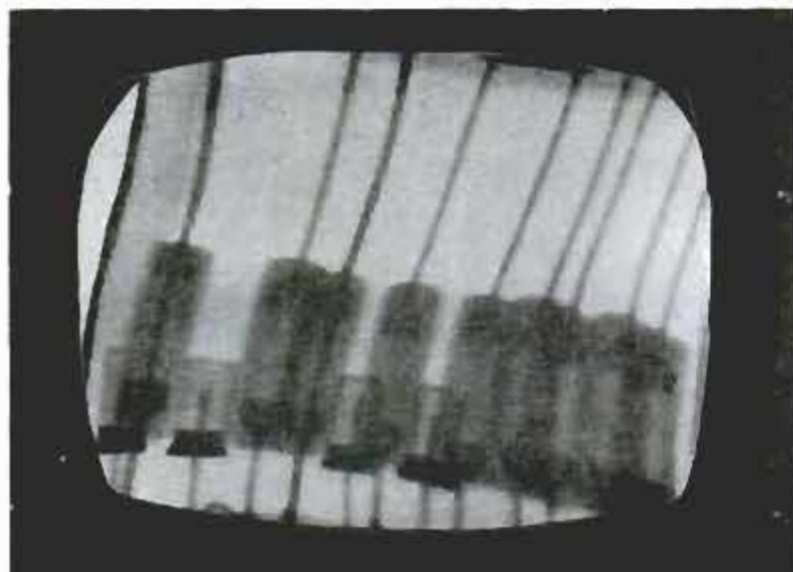


Operator, seated at a remote television monitor, watches X-ray images of parts passing down assembly line

Inspector Checks X-Rayed Products on TV Receiver



X-ray unit plus the special TV camera can be installed almost anywhere on the line to inspect hidden parts of the product. Faulty circuit can be spotted in X-ray of electronic unit



MANUFACTURERS now can "peer inside" their products with "X-ray eyes" to make routine inspections. Every product moving down an assembly line can be X-rayed on a continuous basis. The new technique is made possible by coupling a closed-circuit television system with the X-ray equipment. The system, developed by General Electric, makes it possible for an inspector to sit in front of a television screen in another part of the building and check each product even though it may be sealed inside a metal container. Fluoroscopes have been used for some time to inspect products, but the inspector could work only in a darkened room for short periods of time. The new equipment consists of an X-ray-sensitive TV camera, a control unit and a viewing monitor. It can be used with any standard X-ray generating apparatus. The camera picks up the X-ray image and passes it to the control unit, which feeds it to the 12-inch picture tube. Ordinary TV receivers may be added to the system, making possible simultaneous observations from separate locations. The system is expected to be particularly useful in checking aircraft parts and sealed electronic units.



Piggyback Bridge Eliminates Trestle Supports on Highway

When U.S. Highway 40 was widened at Auburn, Calif., engineers found the steel supporting towers of a railway trestle blocking the road. To clear the roadway,

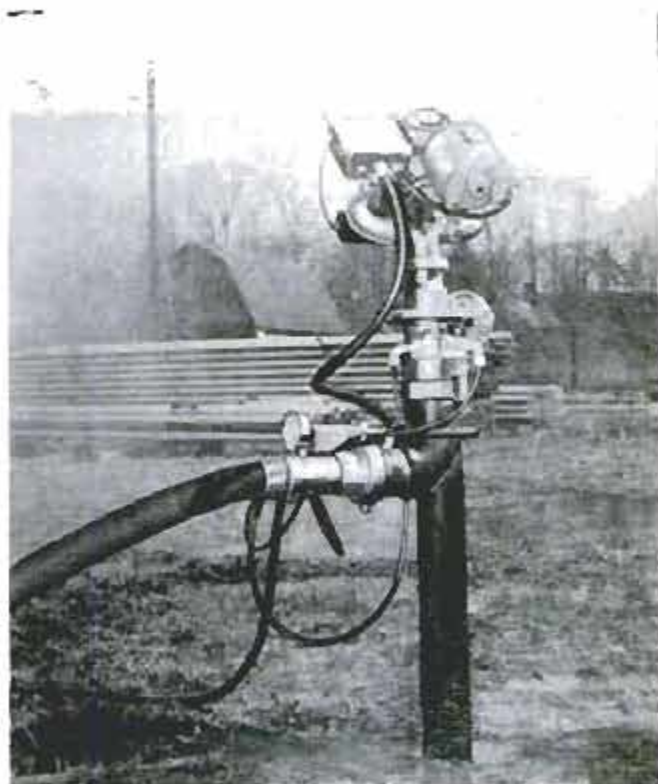
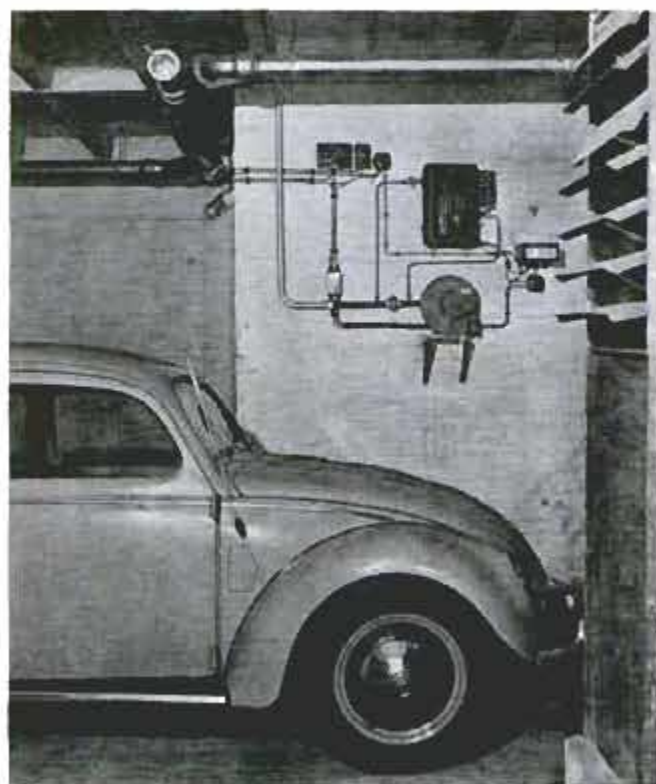
they built a 240-foot-long "piggyback" bridge on concrete pillars beneath the trestle. The trestle is now supported by the bridge.

Carbon-Monoxide Detective

Meters that can detect one part of carbon monoxide in 50,000 parts of air protect motorists who park in Hamburg, Germany, underground garages. The device automatically turns on electric air circulators which remove the poisonous fumes.

Robot Fire Fighters

Automatic fire-fighting equipment has been installed at the Cape Canaveral rocket-launching site. Remote controls in a bunker a quarter mile away can raise or lower the streams of foam, rotate the nozzles or change the width of the stream.



Whirlybirds Reseed Forests



Families are earning extra money picking up pine and fir cones and selling them for their seed values

By Homer Hathaway

A NEW METHOD of reforestation used by Weyerhaeuser Timber Company, Tacoma, Wash., is giving hundreds of families in Oregon and Washington the opportunity to earn "pin money."

The method employs helicopters, affectionately known as "whirlybird cowboys," to spread the seed, while the families get into the act by hunting fir and pine cones to sell to the company. The cones are valued for their seeds. A filled, two-bushel sack brings anywhere from \$4.50 to \$20, depending on the type of cones inside. Last year, families and youth groups in the area earned about \$90,000 cone-hunting.

The cones must come from specific areas, because company research has shown that seeds will thrive best when planted at the same elevation as the parent tree, and under similar conditions.

Reforestation gets under way just as soon after logging operations as possible. Often the area to be reforested has to be plowed, or scarified. Large bulldozers push down the brush left after logging, since brush can choke out the seedlings. The dozer blades leave an exposed mineral soil in which the seeds find a good place to grow.

Chemical sprays, applied by helicopter, are another means used to kill off the com-

peting brush. The helicopter, saving many man-hours in brush eradication, has also proved to be the ideal method for the re-seeding part of the project.

Flying at a speed between 45 and 60 miles per hour, the helicopter never flies higher than 200 feet above the ground on seeding operations. The helicopter's maneuverability is advantageous in areas where it has to dip down between high canyons and mountain ridges.

On each side of the helicopter's bulbous "eye" is a seed tank or hopper that has a 200-pound capacity. Just below each hopper is a power-driven meter for controlling the rate of seed flow. Air tubes from the outlet of the meter lead to a center-mounted, hollow disk, called a slinger, which is driven from the engine shaft. The slinger rotates in flight, distributing seeds in a 90-foot swath.

The seed tanks are loaded evenly to maintain balance when the copter is aloft. While in flight the pilot listens to an instrument that transmits the vibrations of the seeds leaving the slinger. It tells him when all the seed has been distributed from the tanks.

Since the seeds are scattered at the same elevation as the parent tree, the helicopters are loaded with seed for only one 500-



In reseedling, helicopters never fly higher than 200 feet. Their speed is between 45 and 60 miles per hour

foot elevation level. Before they reseed another level, they must return to the ground for a new supply of seed.

Seed is generally scattered at the rate of one pound to an acre. It takes more than 40,000 seeds to make a pound, so an area one-mile square would receive about 25,000,000 seeds. They are sown in a cross-flight pattern that requires two flights over the area, with the second run at approximately right angles to the first. This is the best way yet devised to provide an even distribution of seed. An acre of ground can be covered in about 15 seconds.

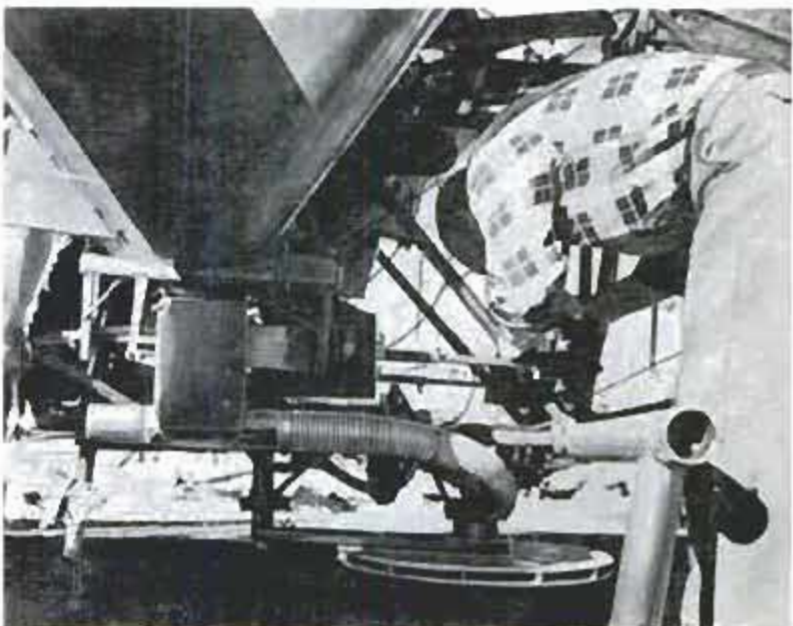
An effective method of rodent control has been developed to discourage this traditional enemy of seeds. With chemical repellents on the seeds, rodents gradually develop a distaste for the seed that normally is their favorite fare.

The helicopter method of seeding has proved itself in two ways: It is much easier than hand planting of seedlings, and it is more practical. Hand planting takes many hours of labor, while the helicopter cuts labor down to minutes.

The operation is part of a long-range forestry program called "Operation Rehab," which has two objectives: To return to production those lands that do not adequately restock after being logged, and to reclaim old timberlands that have been lost to active production because of fires and brush encroachment. ★ ★ ★



Seed tanks are behind helicopter's "eye." Below, slinger throws seed in 90-foot swath at the rate of one acre in 15 seconds





Retractable Dome Will Cover Arena

Both indoor and outdoor events can be staged in a new Civic Arena planned for downtown Pittsburgh. The auditorium, which will seat up to 14,000 persons, will have a retractable roof of stainless steel. The roof will be composed of eight sections, two stationary and six movable. The pictures show the auditorium with roof open and closed. The dome will require about 200 tons of steel.



Cook and Eat "Dogs" While You Drive

Now there's no need to interrupt long motor trips with food stops—if you can exist on a diet of hot dogs, that is. A compact two-barrelled heater plugs into the cigarette-lighter socket and heats two frankfurters at a time. Buns are toasted by placing them atop the heater while the dogs are cooking. It takes about seven minutes to get the first pair of dogs to sizzle, but after that the heating time is reduced to about four minutes, according to the manufacturer.





TV Watches Tots For Motel Guests

Television is the "baby sitter" at a Florida motel. A camera suspended from the wall is trained on the sleeping child. Through closed-circuit TV, a nurse sitting in a central room can tend five children at once. She can speak and listen through an intercom system. If a child cries or doesn't heed instructions, she dispatches an employee to give personal supervision.

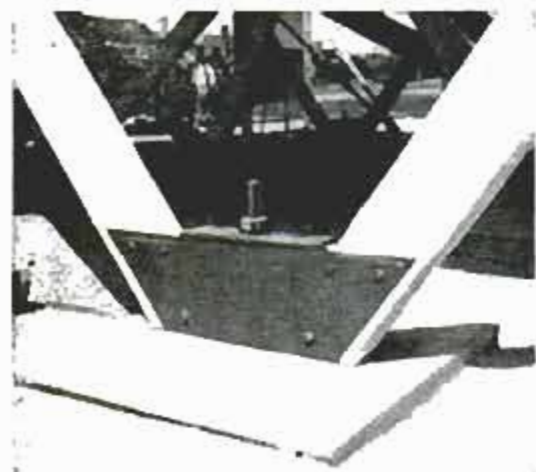


Japanese Police Station Designed With "Peaceful" Motif

Something new in the way of police stations is a circular, glass and brick-wall structure in downtown Tokyo. The designer, Professor Kichiro Taniguchi, insisted

that the building be surrounded by flowers, that birds be kept in a cage to create a peaceful atmosphere and that all policemen assigned to the station be "handsome."





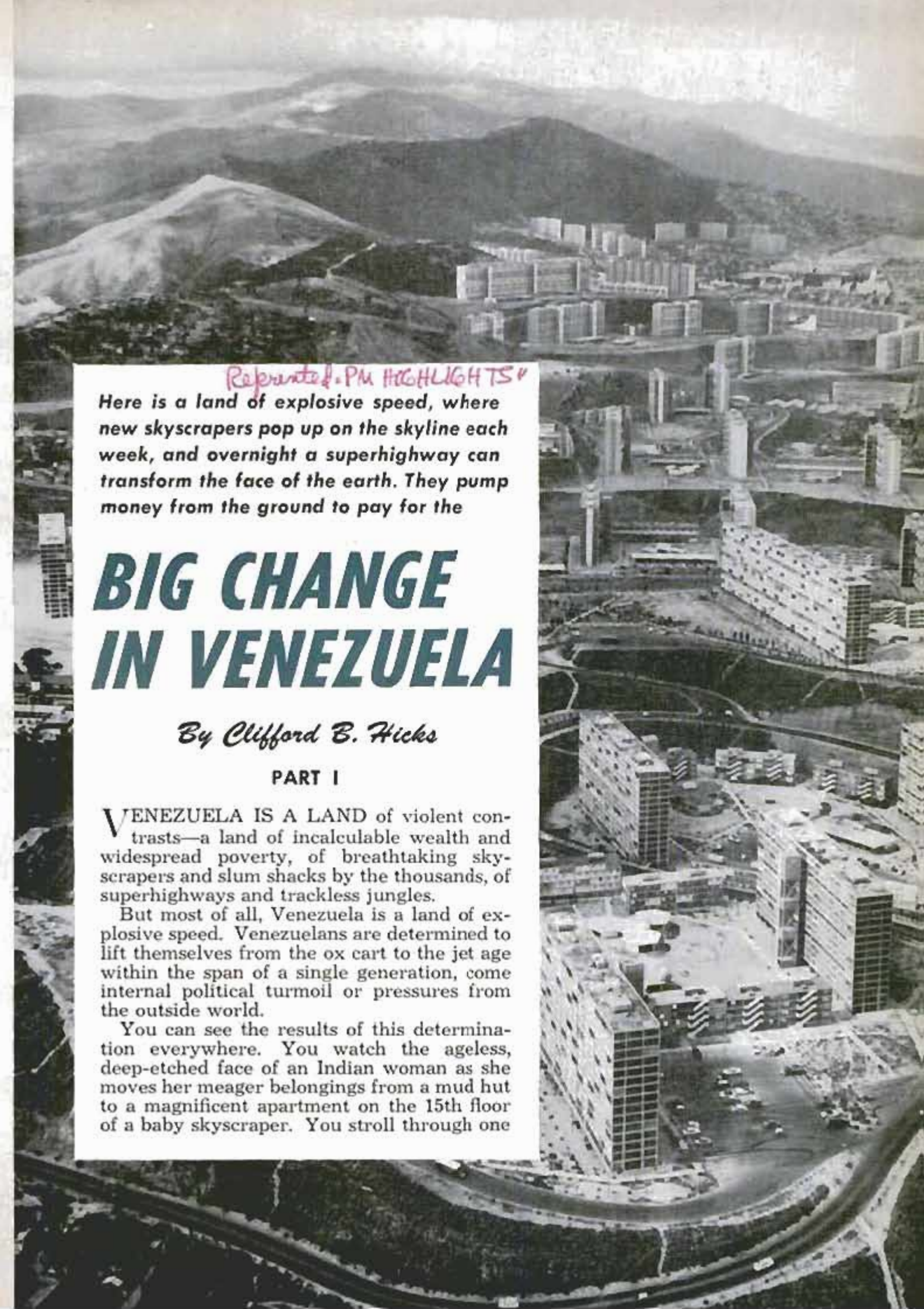
“Hurricaneproof” House on Stilts

Designed to withstand hurricanes and tidal waves is a house on nine-foot-high stilts at North Dartmouth, Mass. The stilts actually are part of a V-strut foundation intended to hold the house in place against the impact of rushing water. The V-struts are anchored to concrete piers buried deep in the ground. Two-inch bolts embedded in the concrete have a shearing strength of 40,000 pounds per square inch. The struts are made of 4 by 10-inch lumber. Screw-threaded nails fasten sidewalls to the studs and framing of the five-room house.

Navigation System Traces Flight Path of Helicopter



Helicopters have their own navigation system, now under evaluation by the Airways Modernization Board. In front of the copter pilot is a pictorial map of his regular route. During his flight, a stylus moves across the map, constantly showing his present position and the path he has flown. The system automatically measures radio transmissions from a chain of stations along the route. It is designed primarily to expedite helicopter operations in busy terminal areas, and is under test at New York City airports.



Reprinted from PM HIGHLIGHTS

Here is a land of explosive speed, where new skyscrapers pop up on the skyline each week, and overnight a superhighway can transform the face of the earth. They pump money from the ground to pay for the

BIG CHANGE IN VENEZUELA

By Clifford B. Hicks

PART I

VENEZUELA IS A LAND of violent contrasts—a land of incalculable wealth and widespread poverty, of breathtaking skyscrapers and slum shacks by the thousands, of superhighways and trackless jungles.

But most of all, Venezuela is a land of explosive speed. Venezuelans are determined to lift themselves from the ox cart to the jet age within the span of a single generation, come internal political turmoil or pressures from the outside world.

You can see the results of this determination everywhere. You watch the ageless, deep-etched face of an Indian woman as she moves her meager belongings from a mud hut to a magnificent apartment on the 15th floor of a baby skyscraper. You stroll through one

AUTOMOBILES



of the world's most modern and beautiful universities with a student whose cousin, deep in the interior, lives a hundred miles from the closest elementary school. You watch Jaguars by the dozens wheeling along the Autopista, and at the same moment, deep in the jungle, a naked Indian is stalking his kind of jaguar with a blowgun.

Venezuela also is the land of the incredible statistic, for only statistics can show the magnitude of the people's efforts to raise themselves to the jet age overnight. Venezuelans love to quote statistics to prove the

magnitude of their effort. Here are a few:

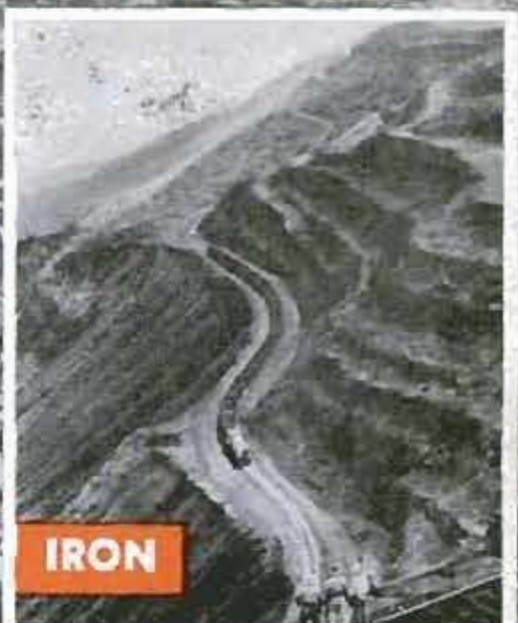
- In the short span of 10 years, 200,000 people will have been moved from shacks into magnificent apartment buildings.

- A huge complex of chemical factories, built in less than three years, soon will be turning out 180,000 tons of fertilizer per year (more than three times Venezuela's own requirements) along with plastics, synthetic rubber and industrial chemicals.

- In just 18 months, thousands of workers and machines toiling day and night moved more than 15 million cubic yards of



SISAL



dirt to build what Venezuelans say is the world's longest earthen dam, a dam that stretches for nine miles and will irrigate 300,000 acres of now-arid land, boosting livestock production by five times in central Venezuela.

- In central Caracas, the 400-year-old capital city, more than 400 buildings were razed to build a magnificent commercial center. Already \$90,000,000 has been poured into the center, and the total cost eventually will reach \$300,000,000 if the original plans are carried out — compared

with \$100,000,000 for our own Rockefeller Center. In 15 years Caracas has been transformed from a sleepy overgrown village of 300,000 persons to an exciting metropolis of more than a million.

- In just 12 months Venezuela completed more than 1000 public-works projects costing some \$500,000,000. In five years more than \$2,000,000,000 have been spent on public improvements.

And Venezuelans seem determined to maintain such staggering statistics, come what may. Following the revolution last





Slum areas (shown in foreground) are cleared as modernization progresses. New apartment buildings now dominate the skyline



Big day for a peasant family! A truck moves the family's meager possessions from miserable slum to one of the new apartments

January, a junta of military officers and civilians took over the administration of the national cash register. One of the first acts of this group was to announce:

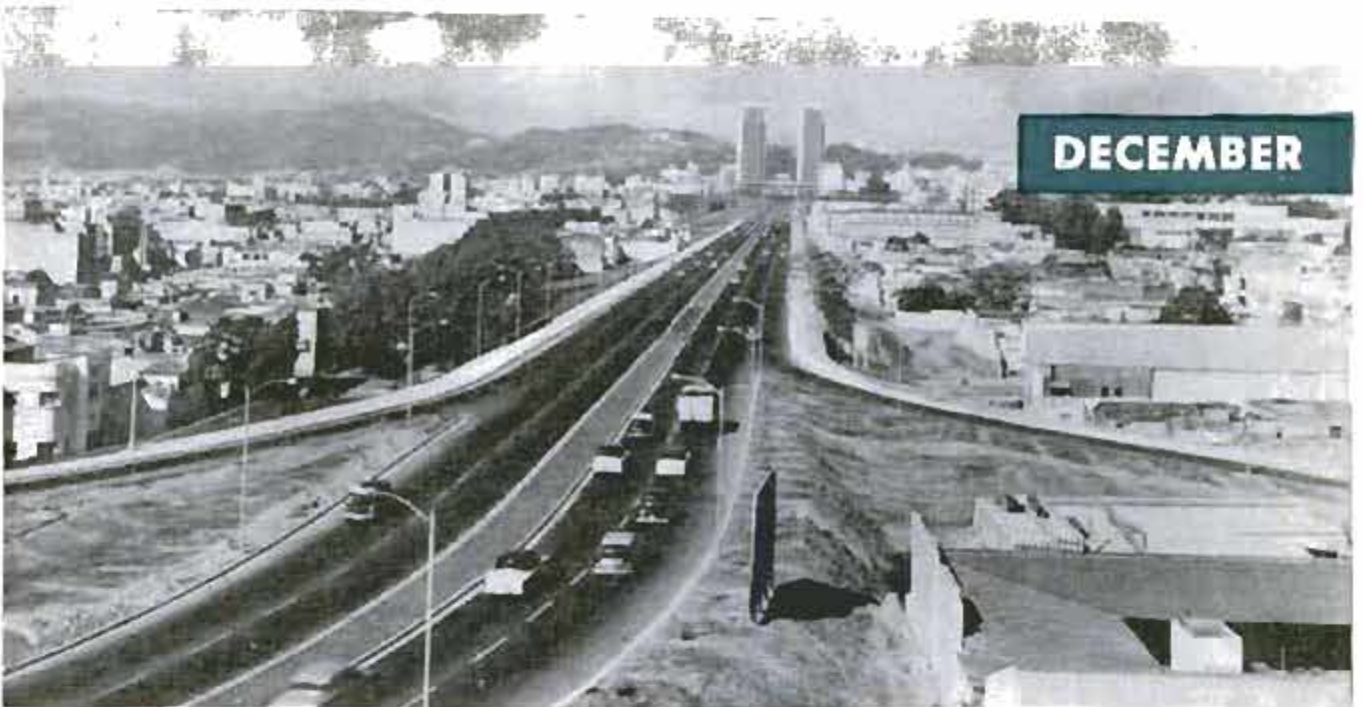
"We intend to maintain a high level of public construction, placing emphasis on projects that are essential, such as railroad, harbor and highway improvements and development of new petrochemical and steel industries. Showplace projects such as fancy hotels and monuments, which often were pushed by the last administration, will have low priority."

Venezuelans are well on their way to their goal of lifting themselves by their oil derricks overnight. Gone are the ox carts around Caracas. Today the new Autopista, a six-lane superhighway, is jammed with Thunderbirds, Cadillacs, Jaguars and Imperials. For centuries the University of Caracas struggled along in the same ancient buildings. Today, with facilities for 7500 students, it is one of the most beautiful and modern universities in the world, boasting all spanking-new buildings within a period of four years. In the mountains above Caracas a 3000-kilowatt atomic reactor soon will yield nuclear energy for scientific research.

The annoyances of high-speed civilization, of course, go hand-in-hand with the benefits. Radios in Venezuela spout endless adver-

Gang of workers terraces mountainside above Caracas to prevent erosion. Grass will be planted on terraces





Incredible speed of highway construction is shown in photos taken from same spot about four months apart

tisements, and Latin-type ducks squawk singing commercials from television screens. In downtown Caracas, prior to the revolution, you had to drop the equivalent of 30 cents into a parking meter for just one hour's parking. (It may be significant that as soon as the revolt was touched off, parking meters were ripped out by the dozens!)

Throughout the populated sections of Venezuela there is a throbbing urgency to tear down the old and build up the new overnight. A stop watch could well be the national symbol. You see construction gangs working 'round the clock everywhere. Nightfall is the signal only to turn on the huge floodlights. Standing on any of the hills of Caracas, you are surrounded by small armies of men working on projects

of breathtaking scope. And, except for the remaining slum shacks, a majority of the multistory buildings within your view have been built within the past 10 years. The sight is electrifying and in a way terrifying, for you wonder how the patient peasants of Venezuela can adapt themselves to this resounding environment of clanging bulldozers and thundering concrete mixers.

Fortunately Venezuela can afford the pace of its progress. It is, indeed, a land of fantastic wealth. Again, only statistics can tell the story. Oil production has doubled since 1950, and now can run as much as 2,245,000 barrels per day. Venezuela is the world's largest oil exporter, and second only to the United States in the production of crude. And the ground will continue to



Showplace hotel of unbelievable opulence is perched on a 7000-foot mountain, accessible only by cable car

gush this black wealth for years to come, for Venezuela has 16-billion barrels of proven oil reserves, six percent of the world's total.

Down in the wild interior of the country are several vast deposits of iron ore estimated at well over two billion tons. In 1957, iron-ore production increased by a third to 15 million tons. Pockets of gold, precious stones and valuable minerals pockmark the trackless jungles. Many areas have not even been prospected.

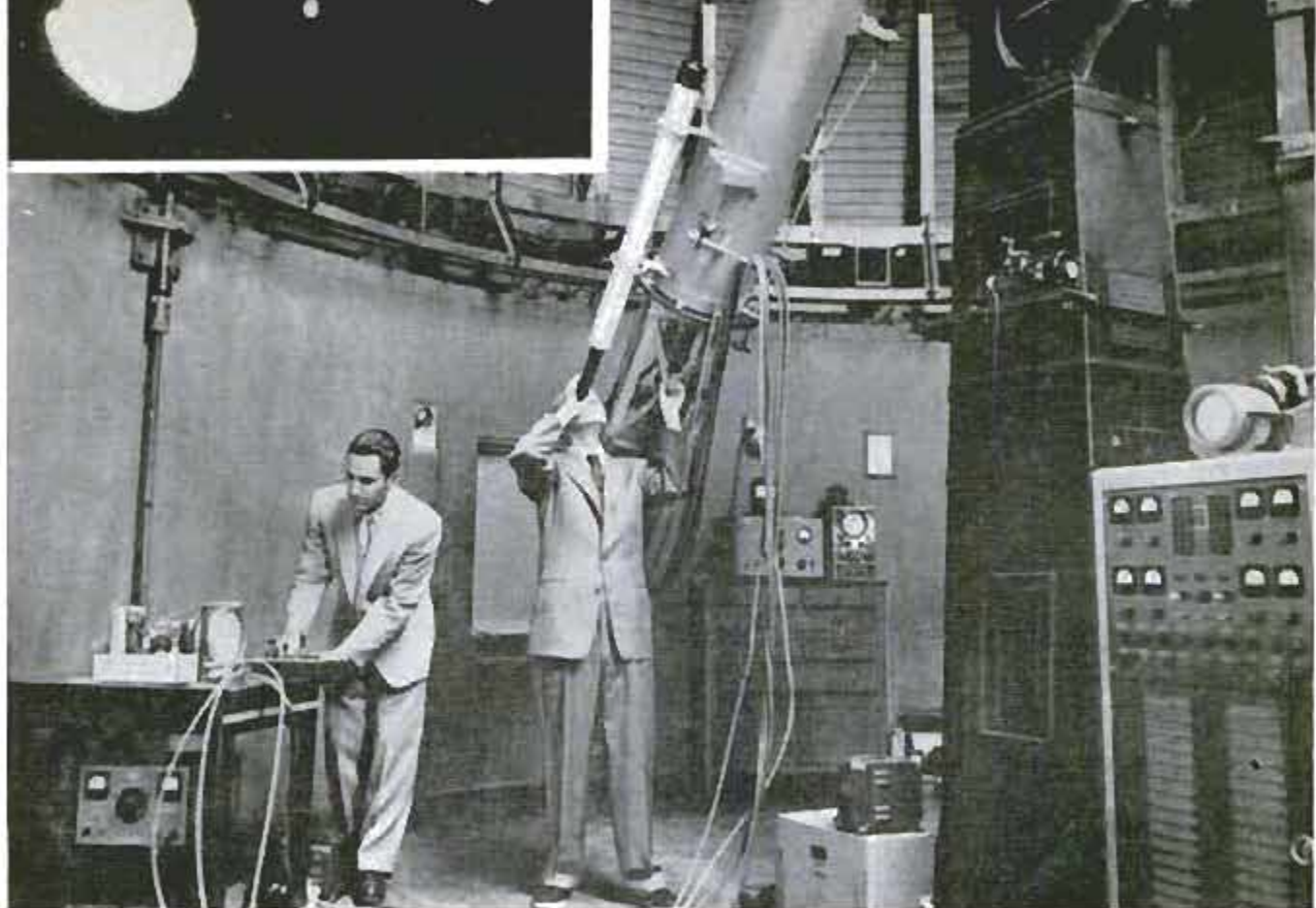
In Venezuela, despite changes in government, it's not a question of whether to spend for vast public works, but how best to spend the money that's pumped up by the oil derricks. In one recent year, 57 percent of the budget was set aside for public works. So far as is known, no other government in history has spent more than 30 percent on such projects. (Another sizeable whack of the budget has gone to equip the armed forces with the latest weapons including jet planes.) Part of the 57 percent for public works went into highways, industries and other projects essential to the economy. Another part went into the tremendous housing projects for lower-income workers.

But a substantial share also went to "showplace" projects, designed for the most

part to impress the rest of the world. A dozen tourist hotels of unbelievable opulence, built and operated by the government, are strewn across the country—but relatively few tourists check in, and many of the magnificent suites stand empty. At the time I visited the Hotel Humboldt, perched atop a 7000-foot mountain and accessible only by cable car, I spotted only half a dozen guests in a building which would put most other hotels throughout the world to shame. The Armed Forces Club, for sheer splendor, would outrank the pleasure palaces of ancient Rome. And at the very moment of the revolution a year ago, workers were putting the finishing touches on a spectacular \$50,000,000 racetrack.

It's a safe bet that the current administration in Venezuela will not emphasize such showplaces. However, projects necessary to a sound and diversified economy, as well as those of value to lower-income families, will be continued. Venezuela is a land of the poor and the rich, with very little in between. Its people now seem determined to use the gushing oil and mountains of ore to improve the living standard throughout the country—and do it at an incredible pace.

(Continued next month)



Electronic "Cat Eye" Photographs Stars in Daylight

Now it's possible to take daylight pictures of planets and stars. It's done with an electronic system called "Cat Eye," which is similar to television and has an optical amplifier 1000 times more sensitive than

that of an ordinary camera. Hooked to a telescope, Cat Eye, left, permits very short exposures in daylight or darkness. The inset shows Jupiter's moons photographed by Cat Eye.

Blind Operators Man Braille Switchboard

Using a Braille switchboard, the blind can now be telephone operators. Attached to the board is a box with rows of plungers. When a call comes, a plunger pops up with

a buzz and the operator locates the plunger and "reads" the station number indicated in Braille below it. She completes the call after locating the number on the board.

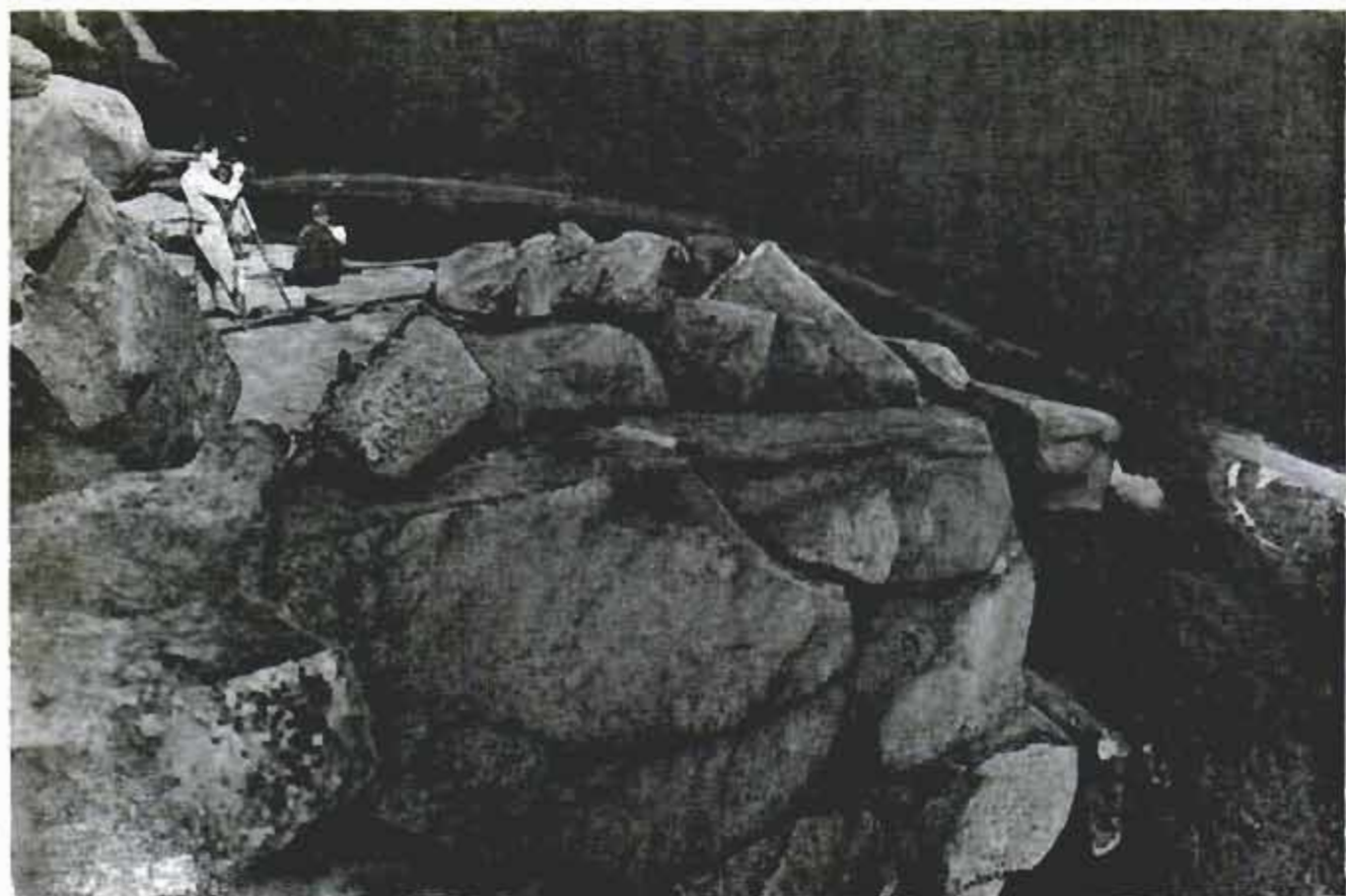


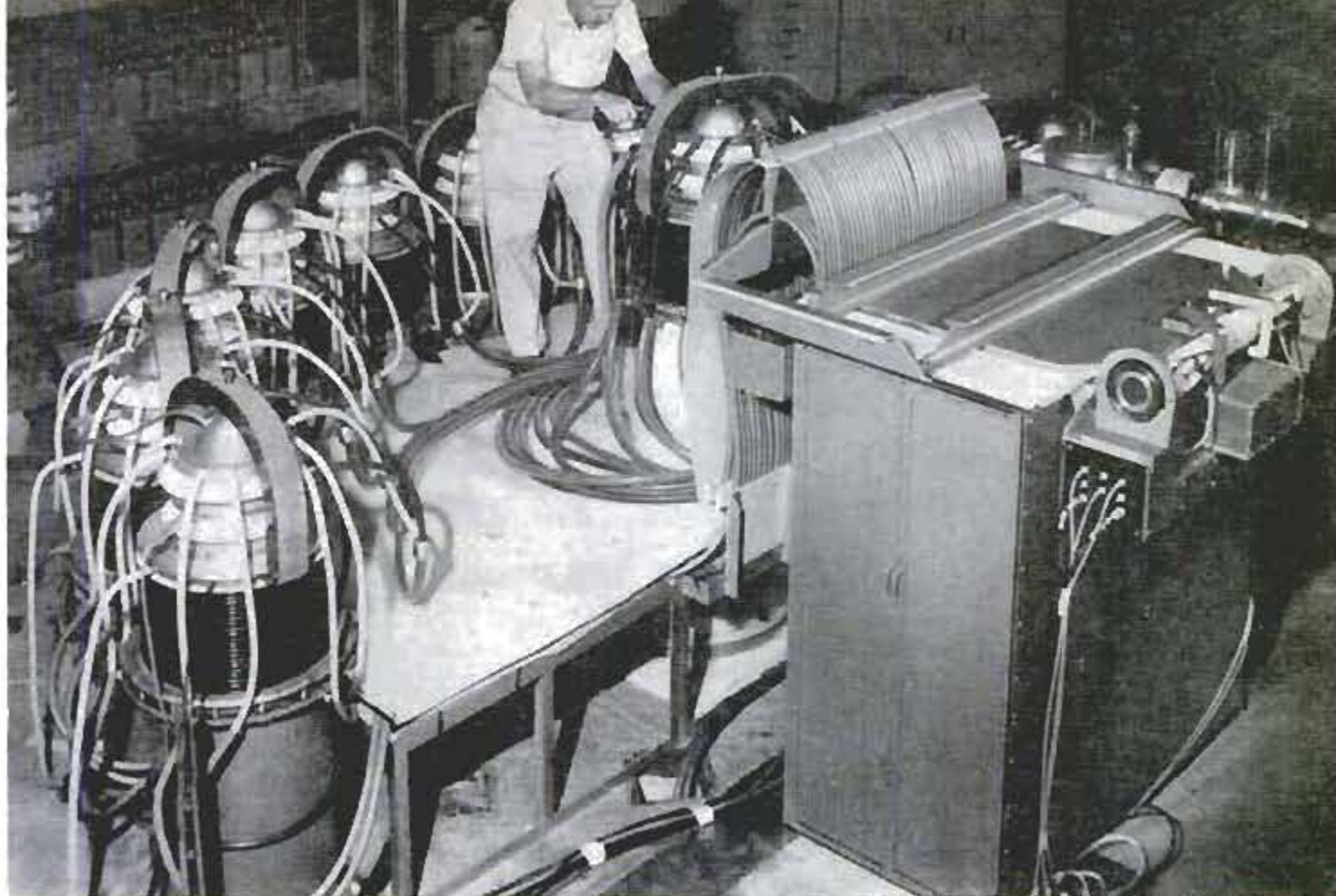


Face-Lifting Operation for the Old Man of the Mountain

FOR NEARLY 150 YEARS tourists have traveled to Franconia Notch, in New Hampshire, to view a natural rock formation that resembles a human face. The formation, called the "Old Man of the Mountain," has shown signs of "aging" in recent years. Freezing weather caused

cracks and seams that threatened to dislodge the boulders that make up the profile. To save the landmark, workmen went to the top of the 1200-foot cliff where supplies were delivered by helicopter. The boulders were tied to the cliff with turnbuckles and the cracks were patched.





Los Alamos Scientific Laboratory photo

Scylla is one of the newest thermonuclear instruments. Bank of capacitors sends tremendous discharge to tube

Reprinted "P.M. Highlights"

Fusion Power for the World of Tomorrow

Here, simply stated, is where we stand in harnessing the H-bomb for peaceful uses. It may come sooner than you think!

By Clifford B. Hicks

THE SCENE WAS straight from a grade-B horror movie. Scientists at control panels pushed buttons and threw switches to create blinding bolts of lightning in a weird array of glowing vacuum tubes.

This was no horror movie, though. It was the Atoms for Peace exhibit of the 1958 Geneva Conference. The visitor could pause to inspect machines with such out-of-this-world names as Stellerator, Scylla, Astron, Alpha, Ogra, Zeta and the mildly optimistic Perhapsatron. The significance of this equipment—and the guarded opti-

mism at the conference—was inescapable.

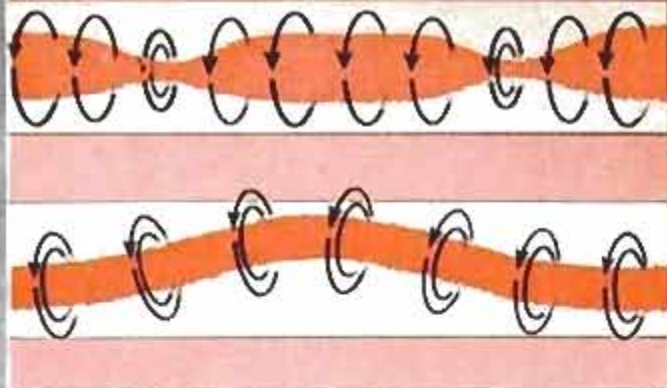
All over the world, scientists are making big strides in their efforts to harness for peaceful ends the fury of the H-bomb.

Indeed, as the visitor paused before the machines in the exhibit hall, he may well have been witnessing nuclear fusion. Some of the scientists have a sneaking suspicion that at least one of the instruments actually was producing fusion energy while it was on display.

The best evidence of progress in this field is not success, but lack of failure. As former



Los Alamos Scientific Laboratory photo



Left, circular tube is used in studies of the pinch effect. Electrical field squeezes high-temperature gas into thin "rope" inside the tube. However, big problem is that "rope" tends to break into "sausage links" or kinks, above, that touch sides of tube. Diagrams at right show the four major approaches in attempts to control fusion

Atomic Energy Commission Chairman Lewis L. Strauss has pointed out: "We think the fact that we have worked with it now for a number of years and have not been able to prove it impossible is a very considerable gauge of its eventual success."

Dr. Arthur E. Ruark, chief of controlled nuclear research for the AEC, confirms the optimism: "There is general belief in the American laboratories that the ignition temperature [the temperature at which the fusion reaction is self-sustaining] will be achieved within a few years."

Proof of success will be the discovery of invisible particles which the scientists wryly call "thermonukes" (thermonuclear neutrons). All over the world, right now, scientists are seeking thermonukes. It's a baffling search because a thermonuke is exactly like any other neutron, so how do you prove the origin of the little beast?

Whether thermonukes attended the Geneva Conference or not, scientists in attendance estimated that sometime within the next 10 to 20 years a switch will be thrown and the first full-scale, power-producing fusion reactor will go into operation. Even this first crude reactor probably will have a power output comparable to the huge hydroelectric plant at Hoover Dam.

That moment, if it comes, will be a pivot point of history. Nations need never fear that their power sources will run dry. For

a time, obviously, petroleum will remain as a source of mobile power, and coal will continue to provide industry with heat. You can't change a way of life overnight. But eventually, according to the experts, oil will give way to some form of stored electrical power which has been derived from the fusion reaction, and coal will be simply another source of industrial chemicals.

At that supreme moment, man can look ahead through the halls of time for literally billions of years and still see a plentiful supply of fuel. *Billions of years!* When new kilowatts are needed, they simply will be plucked from sea water.

Advantages of Fusion

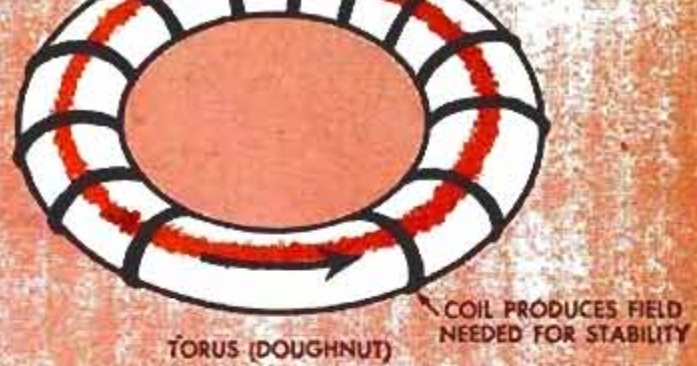
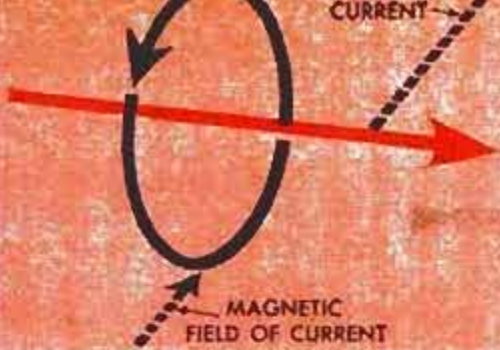
Why will fusion reactors be so much better than today's fission reactors?

1. The fuel supply, as noted above, will be inexhaustible and inexpensive.
2. The problem of disposing of radioactive wastes will be negligible. This is a major problem of fission reactors. The critters are just plain dirty. For example, if all our current energy requirements were provided by fission reactors, we'd have to dispose of radioactive waste material equivalent to that from the explosion of 200,000 atomic bombs *each year*. Fusion reactors will produce very little radioactive waste.
3. The fusion reaction, by its nature, is

Birth and death of possible fusion power: Series of photos of glass tube shows the plasma being squeezed into a thin "rope." Then kinks begin to form, and within microseconds they cause the "rope" to disintegrate

Los Alamos Scientific Laboratory photos





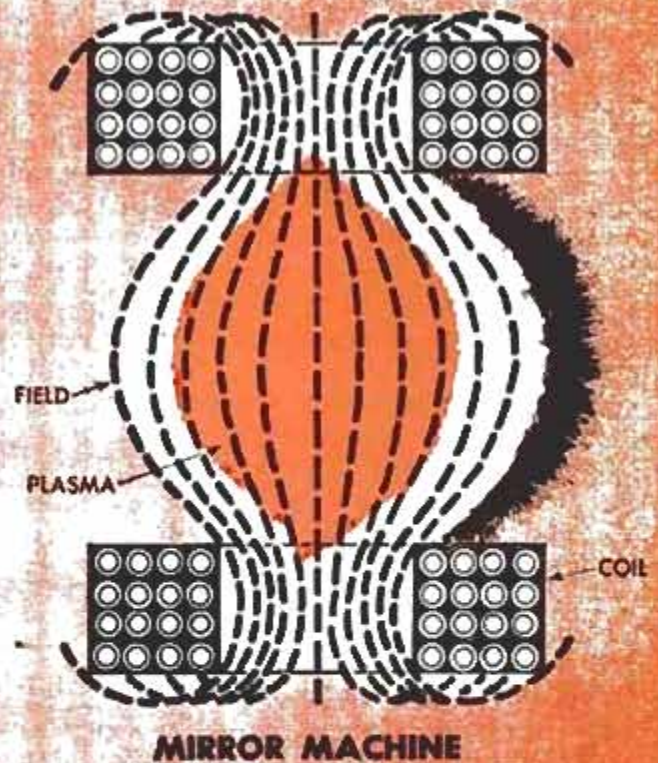
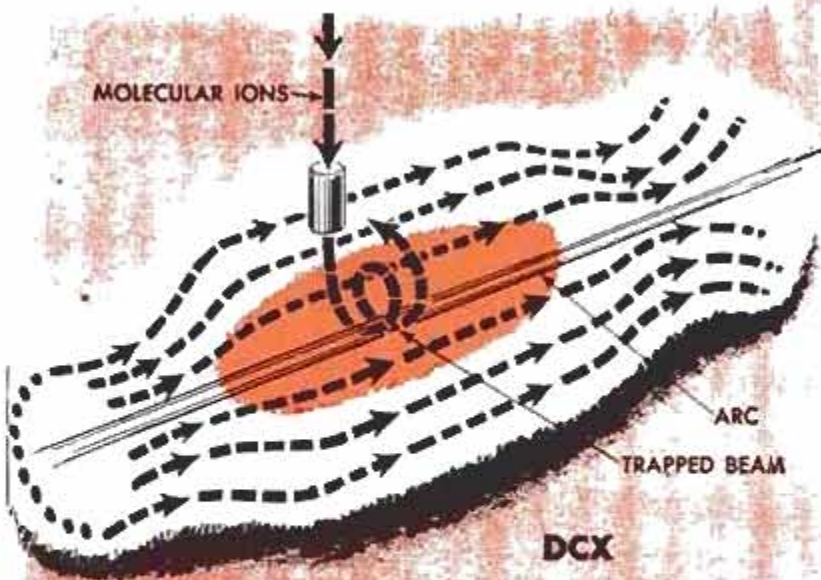
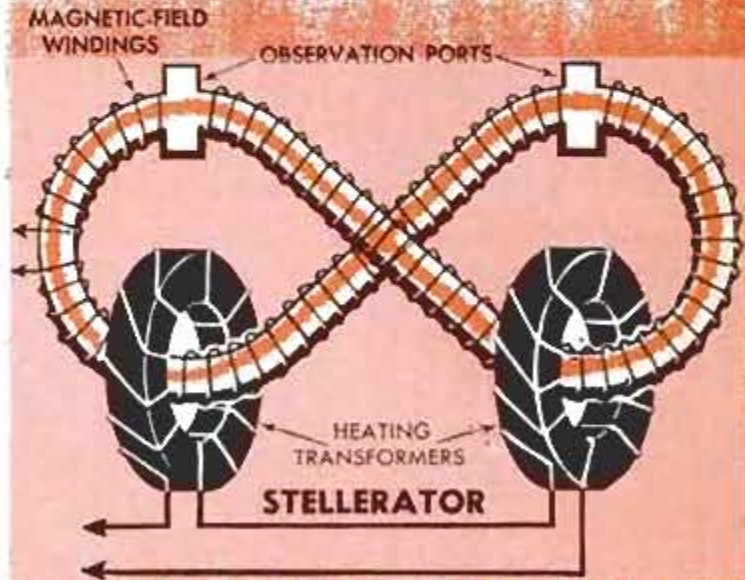
safer than fission. A fusion reactor could never explode. It would simply collapse and fail to function.

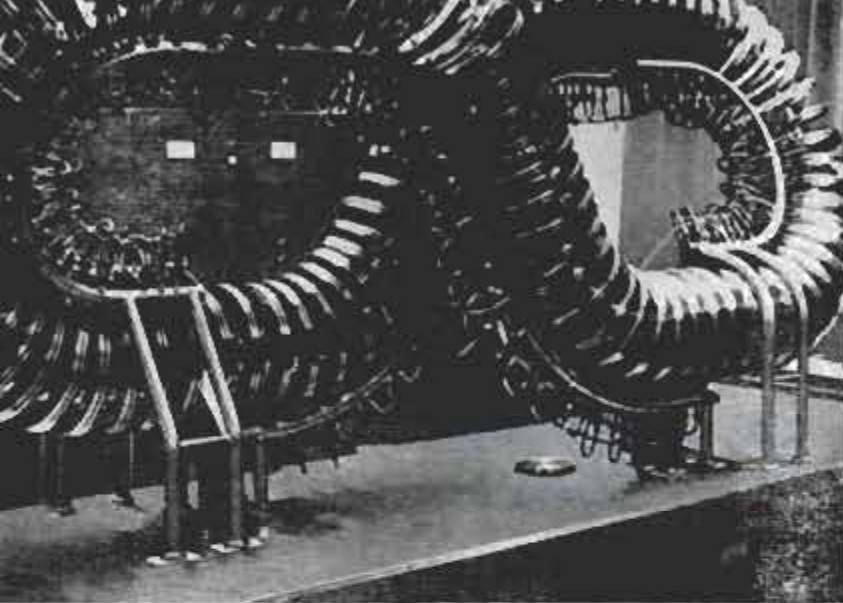
4. There's a fascinating possibility that electricity can be drawn directly out of a fusion reactor. In fission, the reactor produces heat, which then is pumped through conventional turbines and generators to produce electricity. This is a highly inefficient way of producing electricity from nuclear energy.

For these reasons, controlled fusion would be an infinitely greater achievement than wresting power from fission, shooting satellites into orbit or sending rockets to the moon. Indeed, inexhaustible and inexpensive power on earth may well give man the means of navigating to the stars.

Basic Power of the Universe

To achieve fusion, the scientist must crack the secrets of those stars, for nuclear fusion has been generating sunshine and starlight since the beginning of time. It is really the basic source of power of the





Princeton University photo

Novel shape of pretzel-type Stellerator helps prevent kinks from forming, concentrates plasma in the "magnetic bottle"

universe. In effect, the scientist must create a star on earth, bottle it up and clamp on a lid. If he succeeds, he can draw from the bottle any amount of power he wishes.

But each step in this field is a tremendous effort. Dr. Amasa S. Bishop, in a recent AEC report on fusion research, stated that progress may be "slow and halting" because of the many problems involved, but that as yet "no basic obstacle" has been uncovered.

Just what are the obstacles, basic or otherwise? Only a top physicist can understand the mathematics of the fusion process, but the basic idea isn't difficult to comprehend. Suppose you want to bottle up your own star. Here's how you'd go about it:

First, you might be wise to review the differences between fission (A-bomb energy) and fusion (H-bomb energy). In a fission reactor, the nuclei or "cores" of atoms are broken apart. The process has been compared to the explosion of ordinary TNT. Touch off TNT with a blasting cap, and the shock explodes one molecule, which explodes the next, etc., in a chain reaction. Similarly in a fusion reactor, atoms are blasted into particles, which blast other atoms into particles, etc. Poof! You either have an A-bomb explosion or controlled fission, depending upon the speed of the process. In either case you get a scad of atomic particles and considerable energy.

Superhotfoot for Nuclei

In a fusion reaction, however, these atomic "cores" are forced, against their wishes, to unite. This process is somewhat similar to the burning of logs in your fireplace. You give the molecules of the logs a hotfoot by burning kindling under them.

They become so agitated they collide violently, forcing them to unite, and the logs burst into flame. Once the logs are ablaze, the fire itself continues to heat the molecules, so the reaction is self-sustaining. Similarly, in a fusion reactor you raise the temperature to force nuclei to unite. Only in the case of nuclear fusion, you must give the nuclei a superhot-foot, raising the temperature to hundreds of millions of degrees. You must create the temperature of the stars.

For a moment, forget about the problem of kindling such a fire, and concentrate upon the fuel itself. Where do you get atomic "cores" suitable for the fusion process? The most promising source is deuterium, which is simply one form of hydrogen. Turn on the faucet at the kitchen sink, and you'll let an untold quantity of deuterium flow down the drain. Deuterium is found in ordinary water everywhere.

You might suspect that there is a hitch here, that it would be expensive to extract deuterium from water. The United States already is producing deuterium on a significant scale, and published figures indicate that it can be extracted so cheaply that deuterium as a fuel would cost about one percent as much as coal!

Furthermore the quantity of deuterium just asking to be extracted is staggering. Take the current power demand of the entire world and multiply that figure by 1000. There is enough deuterium in the oceans to supply this much power, year in and year out, for quite literally billions of years. No kidding.

Now assume that you have extracted just two of these deuterium nuclei, which are called deuterons. If you can hurl these two deuterons at each other with enough force to make them fuse, you will create three things: helium atoms, neutrons—and from 3.25 to 4 million electron volts, an incredible amount of energy. Here is an example of just how much energy: If you "burn" or fuse just *one pound* of these deuterons, you'll end up with *43 million kilowatt-hours* of electricity, the equivalent in energy of more than a million gallons of gasoline!

If all the deuterium in the world were extracted from the sea and burned completely, it would produce one thousand million, million, million kilowatt-years of electricity, a figure beyond comprehension. To put it in a much more credible way, just

(Continued to page 264)



Jet Helicopter Uses Same Principle as Rotary Lawn Sprinkler

Operating on the same principle as a rotary lawn sprinkler, the Djinn jet helicopter uses air instead of water for its driving force. Air is piped to the rotor hub,

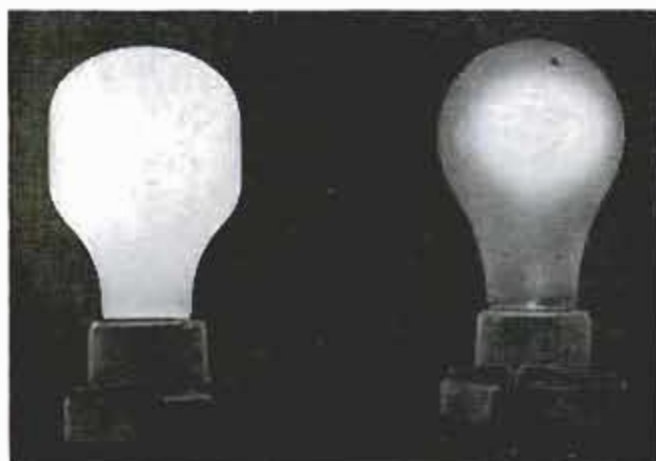
where it is distributed to the two blades through a revolving airtight seal. The air rushes out the blade tips like water from a sprinkler, propelling the rotor.

Will It Show the Butterflies?

Eight photographs can be taken of the inside of a human stomach, in black and white or color, by a tiny camera. The camera fits inside a cigar-shaped stainless-steel shell which the patient swallows.

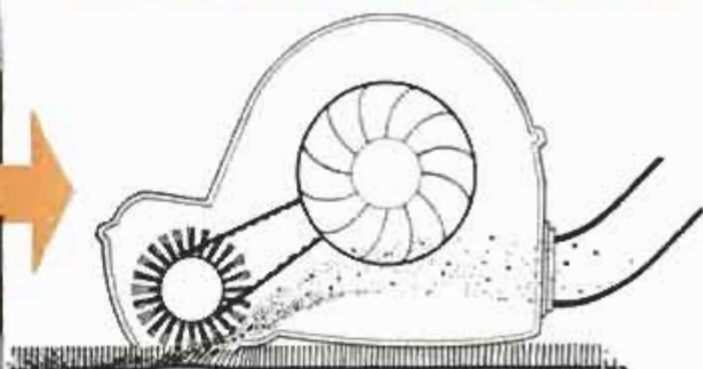
Diffused Light Saves Sight

Soft, glareless light for reading and other close tasks is produced by a new household bulb, below left. The inside of the bulb is coated with silica diffusing material which gives better light distribution.



WHAT'S NEW FOR

Your Home



STEAM COOKER prepares vegetables on top of frying pan filled with boiling water. Enough servings for eight persons can be steam-cooked at one time. Vegetables retain much flavor, color, nutritional value

Kitchen-Mac, 6200 N. Broadway, St. Louis 15, Mo.

BOTTLE-CAP REMOVER loosens and tightens every size of twist-off cover. Versatile wrench-type device also removes vacuum-jar and paint-can lids. It is compact for storage and made of nickel-plated steel

Foley Mfg. Co., Minneapolis, Minn.



ROTATING RUG BRUSH can be attached to tank and canister-type vacuum cleaners. Attachment's motor is powered by air and turns brush, which levels itself to height of nap. Dirt is carried up pipe to tank

Preco Inc., 6300 E. Slauson Ave., Los Angeles 22, Calif.

JALOUSIE SEAL prevents mildew, cuts drafts and holds temperatures in air-conditioned rooms. Made of silicone rubber, it is placed over edges and can be cut with scissors. Color matches that of aluminum

Alto Products, Dept. PM, 482 Riverside Ave., Jacksonville 2, Fla.





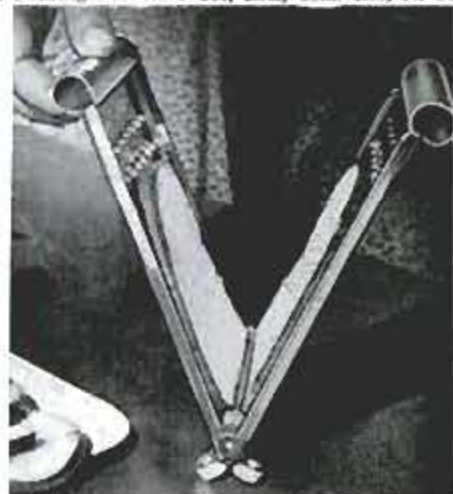
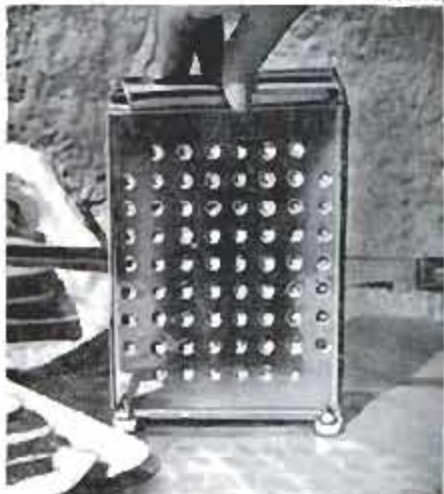
EGG BEATER is operated with one hand by pushing down on handle. Tiny beater whips egg in cup or glass in moments. Besides eliminating need for big mixing bowls for small jobs, beater frees one hand to steady container. It's ideal for mixing drinks, milk shakes and paints

Ekeo Products Co.,
1949 N. Cicero Ave., Chicago



VERSATILE FURNITURE is attractive enough to be used indoors as well as outdoors. Folding chairs and table are made of highly polished tubular aluminum. Wood braces and arms are finished like fine furniture

Telescope Folding Furniture Co., Inc., Granville, N. Y.



MEASURING CUP is two receptacles in one. It measures dry ingredients in one part, liquids in the other. Made of unbreakable, translucent polyethylene plastic, the double cup is 5½ inches high and is colored frosty white. Graduations show on inside as well as outside

Southwest Products, P.O. Box 9421,
Fort Worth 7, Tex.

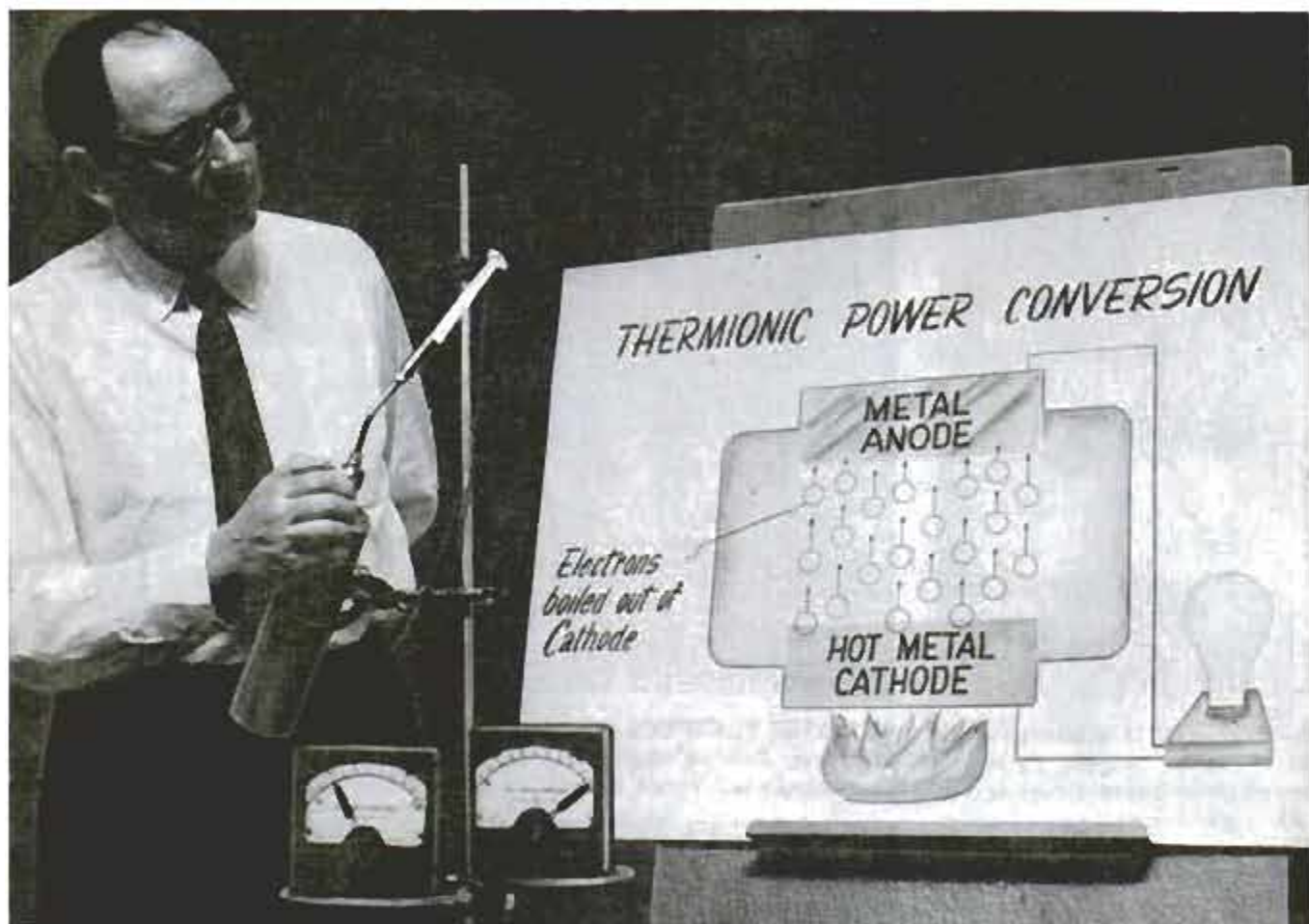
BREAD-SLICING APPLIANCE holds piece of bread firmly and guides knife in cutting it in half for melba toast, canapes, party snacks, patty shells, etc. Metal device has hinged bottom and opens and closes like a book

Ace Products Co., Chalfont, Bucks County, Pa.

RANGE HOOD HAS RADIO concealed under it. Only control knobs are visible. Music from five-tube radio comes through grille. Hood front contains light switch and control button for three-speed ventilating fan

Borns Air King Corp., 3050 N. Rockwell St., Chicago 18.





Electricity From Heat

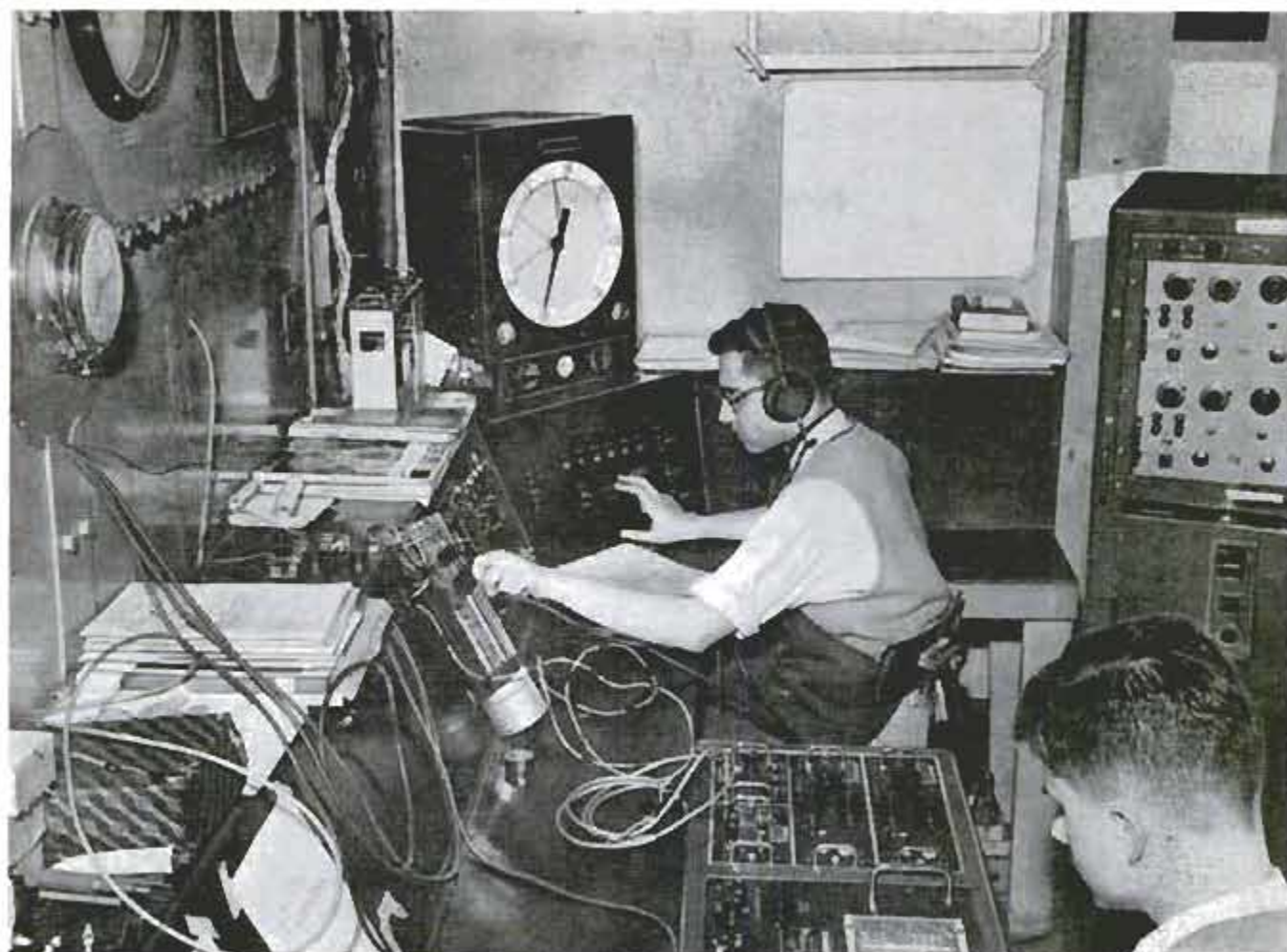
When the flame of a blowtorch is played upon it, a disk the size of a quarter produces electricity. The new "thermionic converter" is a combination of metal and ceramic disks surrounding a high vacuum. There are possible applications wherever a source of high-temperature heat is available and a supply of electricity is needed—such as in missiles.



Slide Rule for Soils Figures Erosion on Farms

How much soil will be lost from a farmer's fields because of erosion? A Soil Conservation Service expert has developed a slide rule that will calculate the rate of erosion when several factors such as the kind of soil, the type of crops and the steepness and length of slope of the field are known. The device figures the annual loss in tons of soil per acre. The slide rules are not available to the general public; they are issued only to soil-conservation technicians. They are designed for use primarily in Midwestern states.





Massachusetts Institute of Technology students test homemade rocket motors from this control console

ROCKET SHOOT at M.I.T.

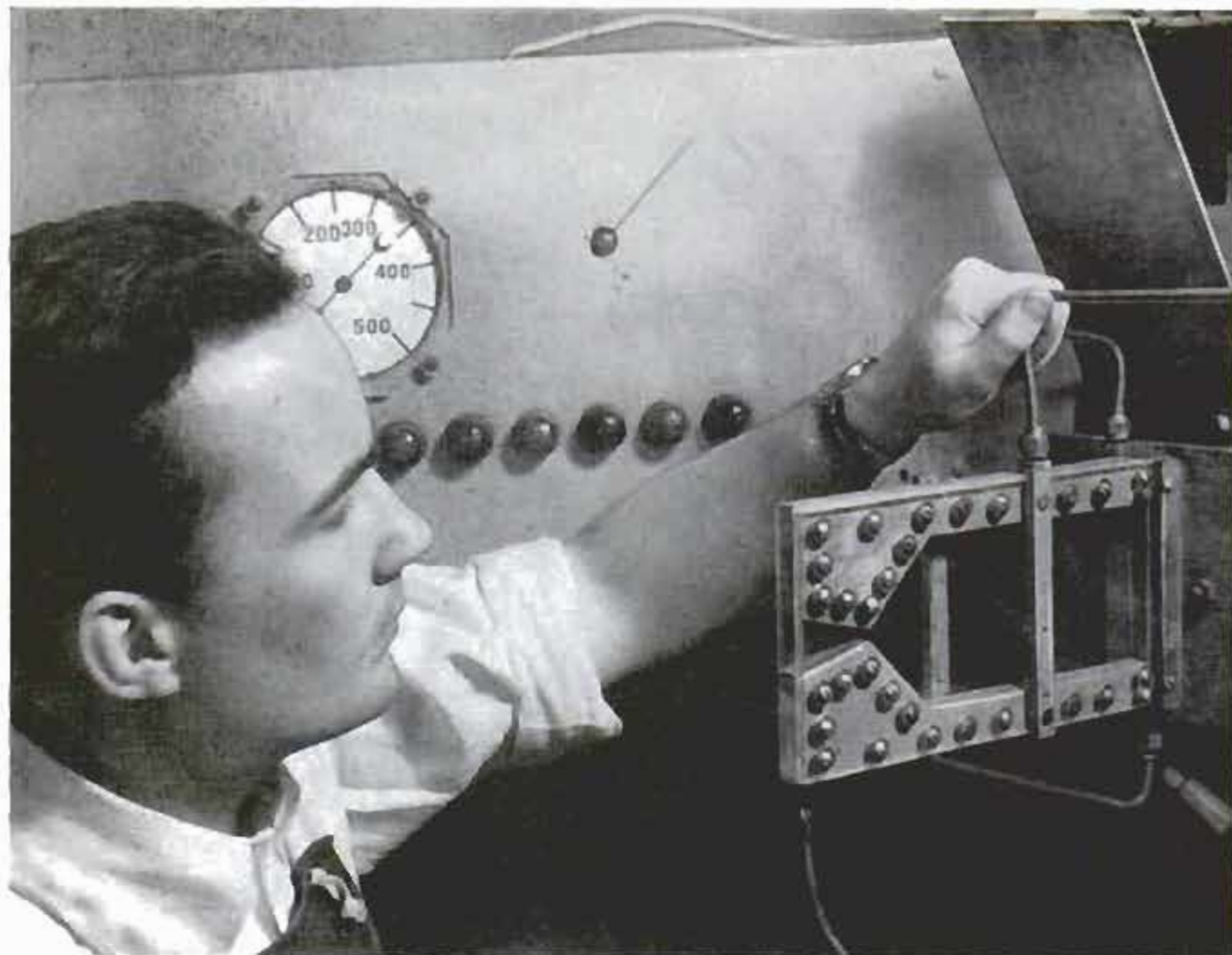
By Michael Day

MUFFLED ROARS, beginning like claps of distant thunder, rumble through the basement corridors of the main building at Massachusetts Institute of Technology these days. But no one looks out, puzzled, at the clear blue sky anymore. Everybody knows what's up—the student Rocket Research Society has just “blasted off” another rocket engine on a static-test run in its armor-plated cell downstairs.

The thunder started five years ago when a group of determined amateur student rocket enthusiasts at M. I. T. wanted to make live studies of rocket-propulsion systems. Scouting military-surplus depots, they stumbled across a ponderous test cell about 10 feet square, made of one-inch steel armor plate. It had been used in a World War II research program to test fuels for high-altitude-burning properties. The multiton affair rode to the campus on a flatbed

truck, was jockeyed into its donated location in the cellar, and became what the amateur rocketeers believe is the finest, safest, amateur rocket-testing facility in the country.

Today, if you wander into their shop during a firing, you'll find most of the 37 members busy at a complex of home-assembled instruments and switching consoles reminiscent of a Canaveral test-pad blockhouse. All are engrossed in measuring and tabulating things like thrust, burning time and combustion-chamber temperatures, as white-hot flame scorches from the exhaust nozzle of an experimental homemade rocket engine bolted to a floating steel rack inside the vault. One man watches through a six-inch porthole of layered glass, alert for signs of malfunction. If there's an interesting motor on the stand, several members can watch at once



Experimental rocket motor with transparent plastic sides is mounted for static test in M.I.T. test facility

in a mirror rigged for peering through the port to reflect what's happening inside the vault.

Last year, under Reece Roth, their president (who won a \$1000 American Rocket Society award for his paper on a new way to measure rocket-exhaust velocities), the group ran 31 live firings with seven rocket

Remains of homemade rocket motor that exploded during static firing emphasize the need for safety



motors turned out in their own shop. Nearly all were made on a donated old metal lathe they rebuilt. Most test motors are steel cylinders six to ten inches long and capable of about five pounds' thrust. One, a unique affair for studying ignition and combustion patterns, has flat Lucite sides. Students can see the flame burning inside the combustion chamber. "The Lucite stands up about five seconds," says Roth, who designed and built it. "That's long enough to collect interesting data."

Though strictly an amateur group, there's nothing amateurish about the way these rocketeers work. Most are mechanical engineering and physics students.

"We keep a complete log of each firing," says Roth. "And the accent is on safety. Many amateur groups like to fire flight rockets. Besides being dangerous, such ventures yield little data." This year, the M. I. T. rocketeers debated sending up a sounding rocket they'd designed. The idea was dropped when all agreed the only thing they could learn would be the peak altitude reached (30 miles on paper). "Our membership hasn't flown a rocket since 1953 when the static-test chamber was installed," Roth reveals.

Fuels, one of the most hazardous ele-

ments in amateur rocketry, are handled with some tricky safety gadgets devised by the M. I. T. amateurs. Mix for solid fuels, such as asphalt and potassium perchlorate, is stirred up in a steel box inside the vault, by a man standing outside. He works a paddle handle that extends through a tiny hole in the wall.

Liquid and gaseous fuels feed to test motors via fuel lines from outside tanks. Automatic cutoff valves are shut electronically at the first hint of malfunction. Backstopping this is a manual cutoff switch to shut everything down and a carbon-dioxide bottle that turns on automatically if things get hot.

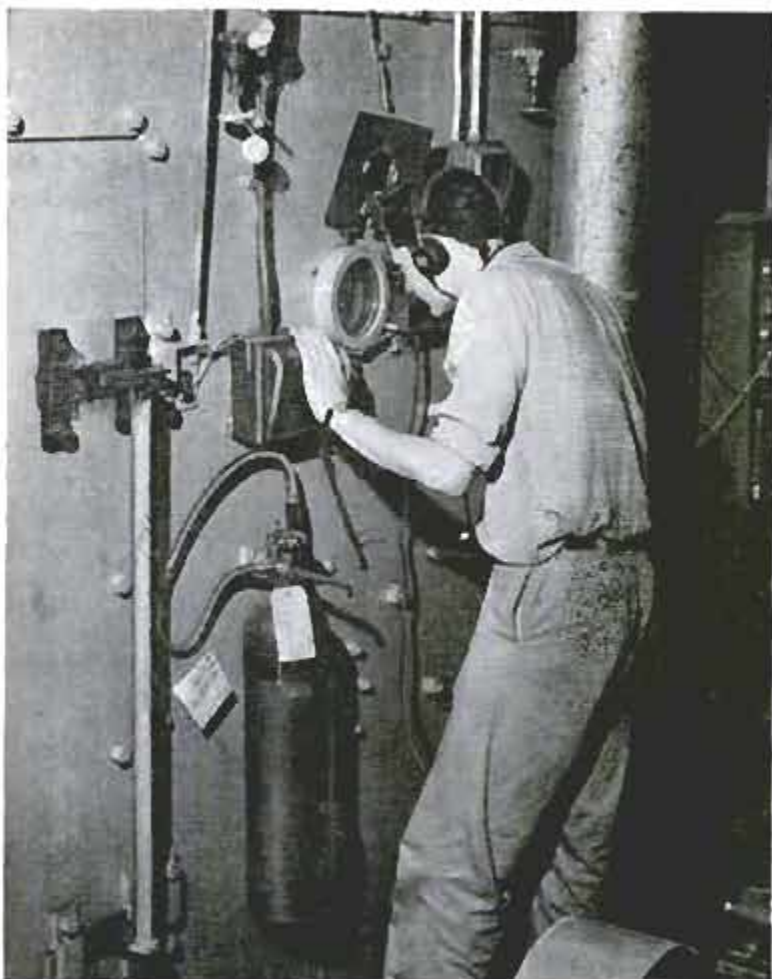
Amateurs in Trouble

"Many amateur groups got in trouble using fuels like zinc and sulphur," says Roth, "probably because they're easy to obtain. But they're tough to handle, detonate easily and give only 40 percent of the performance of liquid fuels. Amateurs using solid fuels should be sure they're really solid—not granular powders. Even in a long, pencil-thin rocket, granular fuel of this type can burn down an entire five or six-foot column in about $\frac{1}{1000}$ second, and chances are good that the rocket will explode."

With all the precautions built into the M. I. T. rocketeers' lab, Roth has an impressive collection of twisted and distorted chunks of solid cylindrical steel two inches in diameter. Once they were rocket motors. One of them blew a steel plug against the vault wall with such force that it folded open like a flower.

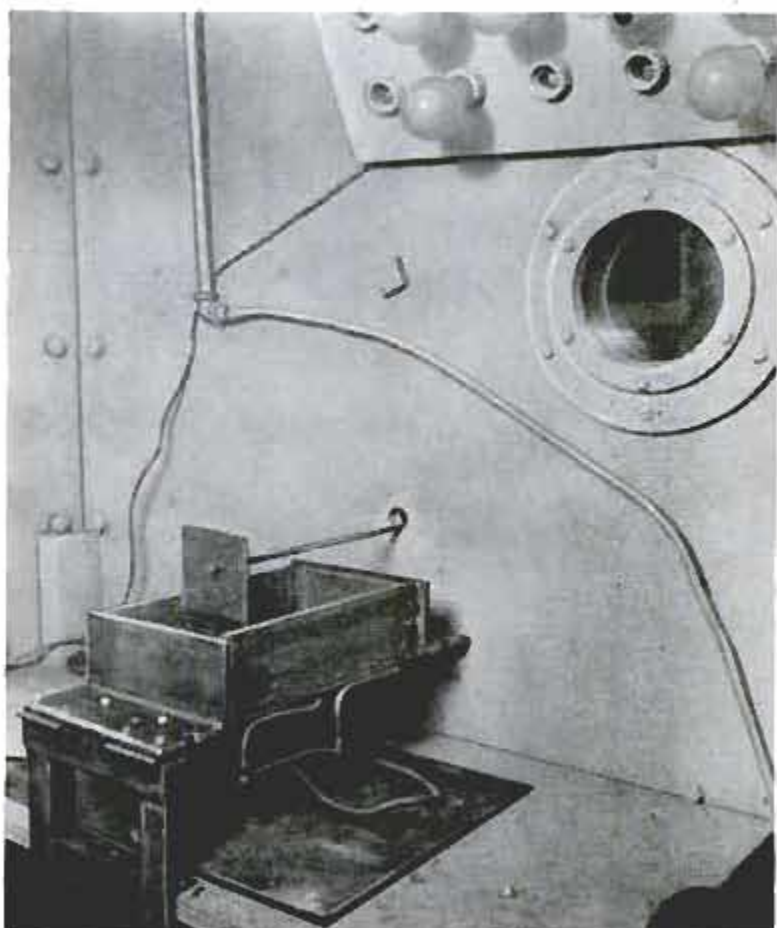
To other amateur groups who query him for advice, Roth usually points out that there are two safe ways to static-test rocket motors: "You can enclose the motor in an explosionproof case," he says, "or you can enclose the people in a blockhouse. A supervised group can achieve the first solution by working out a well-planned pit with good walls and bunkers." ★ ★ ★

☐ Banked turn-offs will permit pilots landing the new jet airliners at Indianapolis airport to turn from the main runway to feeder runways at speeds up to 63 miles per hour.



Observer watches rocket-motor test through safety-glass port-hole. Test cell has walls of inch-thick steel armor plate

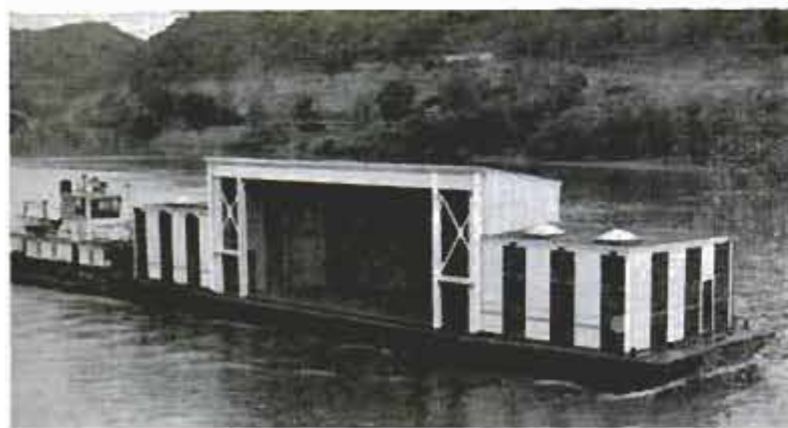
Even rocket fuels are handled with caution. Student outside test cell works paddle that mixes fuels in small steel box





Barge Becomes Stage

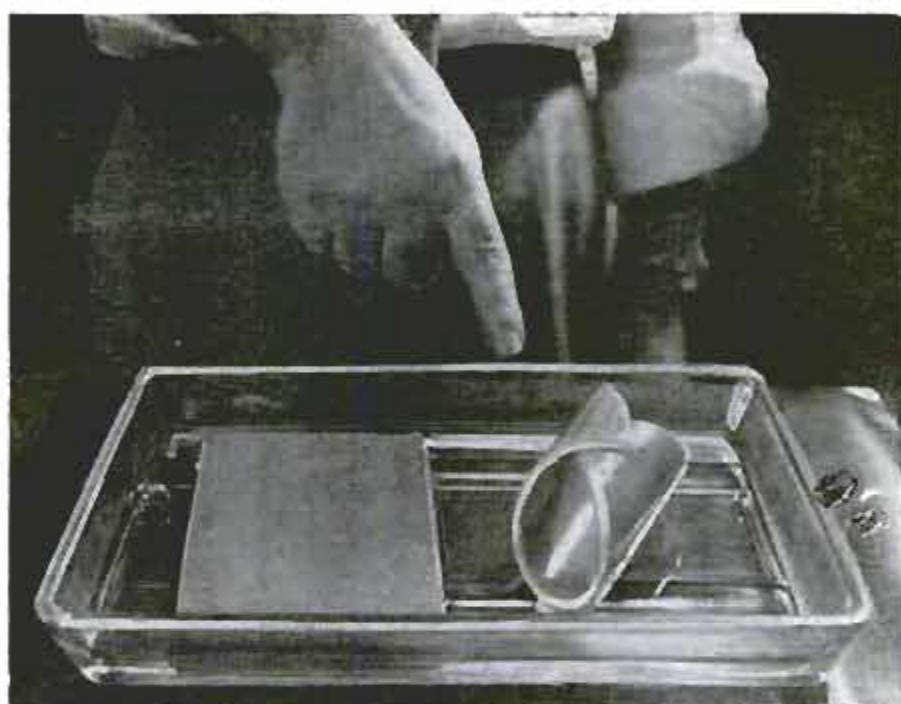
In little more than a month, a barge formerly used for carrying construction materials around Pittsburgh was converted into a floating stage. After the barge's cargo box was removed, a concrete deck was built on top of the steel deck. Then the stage was erected and two rehearsal rooms added.



Radar Through Trunk Lid

Chicago police are spotting speeders with a radar set mounted inside a squad-car trunk. Since a radar beam would be deflected by the trunk lid, alterations were made. The inner taillights were removed and panels, painted to match the car, were bolted over the openings. The panel in front of the set is Plexiglas, which doesn't interfere with the radar beam. The other panel is made of hardboard. Cars moving in either direction are tracked by the set, which reports speeds on a meter.





Chemically Treated Rubber Resists Oil and High Temperatures

Better seals and gaskets for cars and planes are expected from a nitrile-silicone rubber developed by General Electric. In the photographs: An O-ring of ordinary

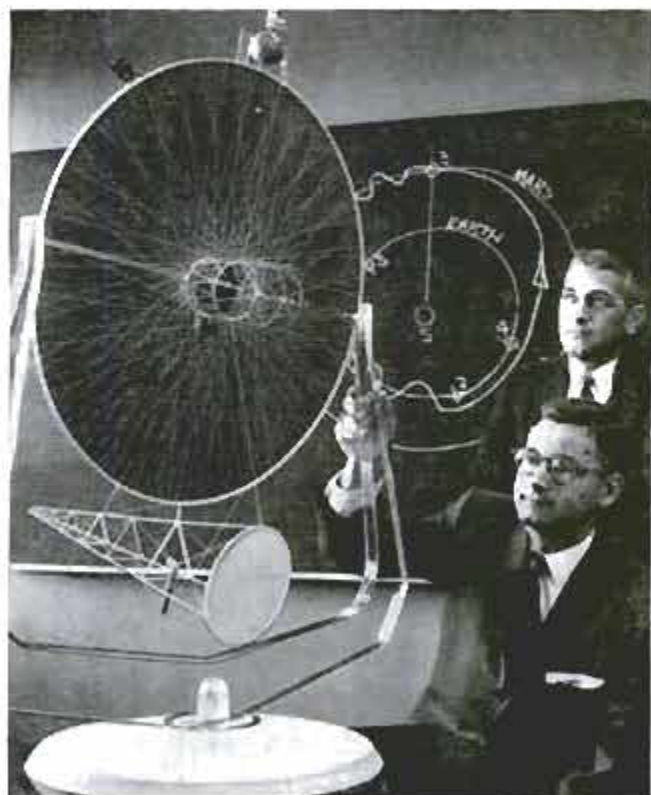
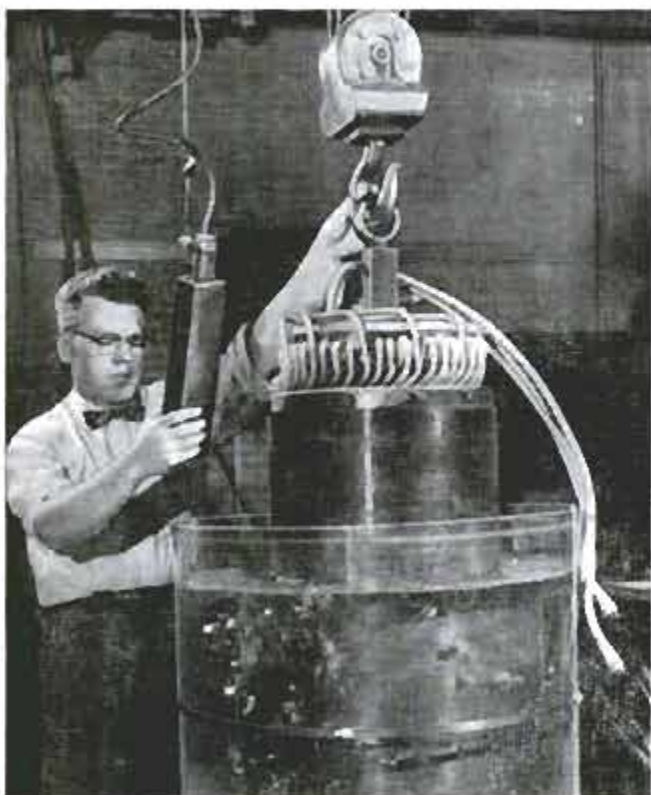
silicone rubber swells in boiling jet-engine fuel while a ring of the new material maintains its size and shape; a sheet of ordinary silicone rubber swells and curls in jet fuel.

Plastic-Protected Motor Works Underwater

Special insulation systems using irradiated polyethylene permit electric motors to work while immersed in water. The motors can be used for boiler-circulating pumps, in mines and sewage plants. Water circulates through the windings, bearings and magnetic parts without damage.

Unmanned Space Vehicle Designed for Trip to Mars

Boeing scientists have designed an unmanned space vehicle that could make close-up studies of Mars. They've built a $\frac{1}{20}$ -scale model of the vehicle, which at full size would be about 40 feet across and weigh 600 pounds. Images received by its telescope would be transmitted to Earth.





Westinghouse Electric Co. photos

In Your Future: Rolling Refrigerator, Portable Bottle Warmer

Hostess carts that warm and cool foods in separate sections, and bottle warmers for traveling parents, are among electrical appliances now in the experimental stage. They use a new principle of refrigeration

and heating by devices that occupy little space and have no moving parts. The cart can be operated on batteries. The bottle warmer, which plugs into the car's cigarette lighter, also can be set to cool the bottle.



Fastener of Nylon Strips

Clothing, upholstery and other items can be held securely by a fastener that consists of two strips of nylon. One strip has a velvet-type surface with thousands of tiny loops. The other has thousands of tiny hooks. When the strips are pressed together, the hooks engage the loops. To open, you simply peel the strips apart.

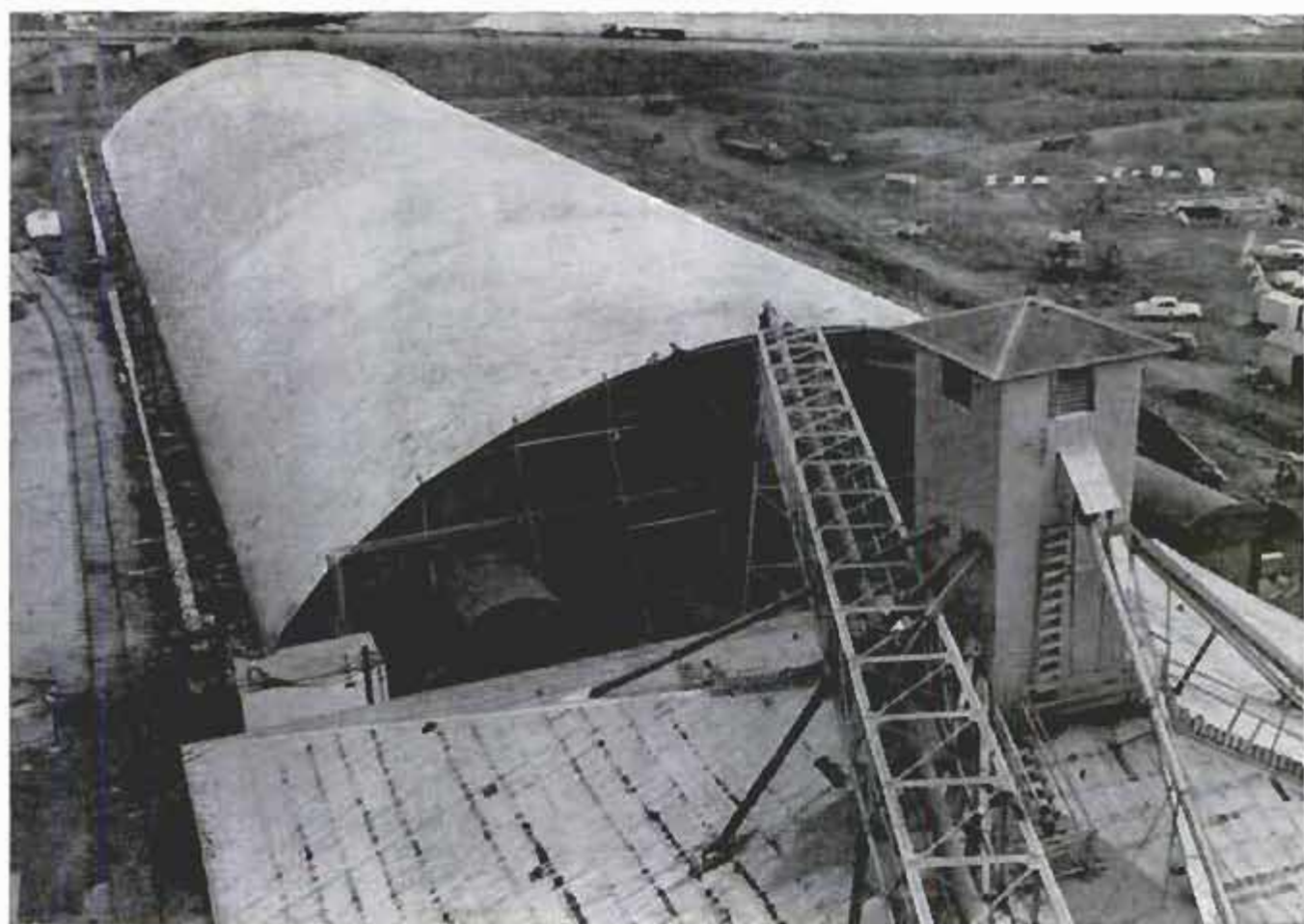
Snow-Plow Blade Can Be Attached to Rotary Mower

If you have a push-type (not self-propelled) rotary mower, you can attach a snow-plow blade to the machine and clear a 24-inch swath through a heavy snowfall. The snow blade bolts to the engine-base adapter plate of most four-cycle engine mowers with cutting widths up to 22 inches. The blade is made of extra heavy-gauge steel which is ribbed for added strength. It will move up to eight inches of dry or five inches of wet snow.



Eyes Generate Electricity In Normal Light

Your eyes generate about $\frac{1}{10,000}$ of a volt of electricity while reading under normal room light. This is the estimate of Dr. Leo E. Lipetz of Ohio State University, a biophysicist. The scientist has been studying the electric current produced by nerve cells in the eyes of animals. The current is amplified about one million times and its patterns studied on an oscilloscope screen.



Air Holds up Steel Roof

Weighing more than 50 tons, the steel roof of a new grain storage building is held up by air pressure. The roof, made of aluminized-steel sheeting, covers 2.3 acres. End walls made of steel were erected first. The strips of roof sheeting were welded on the site. Then giant fans built up air pressure to lift and hold the roof in place. Entrance is through air locks.



Blind Learn to Read by Hearing Sound Patterns of Letters

Persons who are totally blind can learn to read printed material, including typewritten letters, with an electronic device called an aural-reading machine. When its probe is moved over a printed page, photocells translate each letter into a sound pattern with a specific pitch. The sounds do not resemble spoken words but are more like musical tones, or organ chords. By interpreting the tones, the blind person ultimately can attain a reading speed of 30 words per minute. The device was designed by Battelle Memorial Institute of Columbus, Ohio.



The CRUISER With the SUPERSONIC STING

By J. A. Lynch, Ensign, USN, and M. D. Buoncuore, JO 1, USN

THE RECENT commissioning of the USS *Galveston*, guided-missile light cruiser, was a unique event in the annals of modern naval history. The long and once-independent histories of the ship herself and the Talos missile that forms her most formidable armament are both of considerable interest. But it's the successful termination of these two formerly divergent projects that presents an example of the modernization of the new Navy.

Had the *Galveston* been completed, as scheduled, in the period just following World War II, she would have been armed exclusively with six-inch guns able to fire about 10 miles with accuracy. Today the *Galveston* is fitted in part with traditional armament, but it's also equipped with the Talos, which can be effective at distances up to 65 miles. The Talos affords not only greater range, but also more accurate firepower. With only six-inch guns, the *Galveston* would have been just slightly more effective than her namesake in the Great White Fleet.

The Talos ramjet missiles can destroy enemy aircraft within 65 miles. They are equally effective against surface targets



The construction of the *Galveston* was authorized by Congress on July 19, 1940. Her keel was laid February 24, 1944, and on April 22, 1945, the ship was launched. Final construction was halted after the war, and the nearly completed ship was turned over to the mothball fleet.

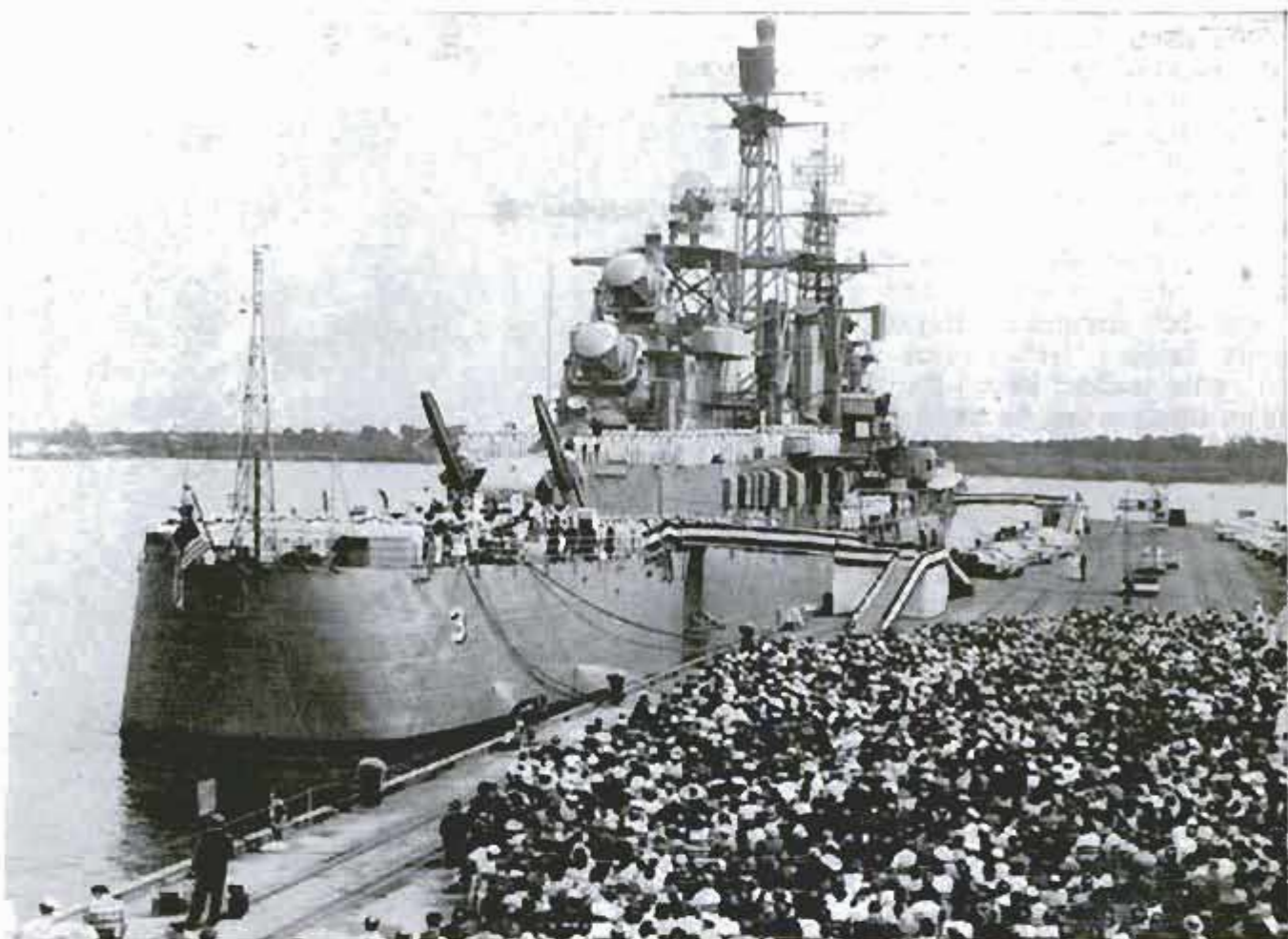
On February 4, 1956, the Navy Department decided that the *Galveston* should be completed and partly redesigned to be the first ship to house and launch the deadly Talos missile. This remodeling involved the complete recasting of the afterpart of the ship's structure. On May 28, 1958, she was finally commissioned—nearly 18 years after being first authorized.

About the time the *Galveston* was being launched in 1945, the Navy's Bureau of Ordnance began the highly secret "Operation Bumblebee." The Bureau asked the applied physics laboratory at Johns Hopkins University to suggest a means to combat the Japanese kamikaze menace. Why the name was chosen for the project is uncertain, but it is believed that it may have been prompted by a slogan displayed throughout the Johns Hopkins laboratory: "According to recognized aerotechnical tests, the bumblebee cannot fly because of the shape and weight of his body in relation to total wing area. But the bumblebee doesn't know this, so he goes ahead and flies anyway."

Not Impossible After All

At the time, the task of developing a ramjet engine to power the flight of a military weapon seemed almost as impossible as making a bumblebee fly. The ramjet had been a theory in physics since before World War I, and was thought to hold great promise as a supersonic engine. But it would not work efficiently unless boosted to nearly sonic velocity. Solid-propellant rockets, such as the German V-2, were thought to be a possible answer.

On June 15, 1945, the long-awaited practical demonstration of a ramjet engine took place. A ramjet fashioned from the exhaust pipe of a Thunderbolt warplane made a successful flight over the sand dunes of Island Beach, N. J.,



At commissioning ceremonies, the USS Galveston was heralded as the first new ship of a new naval era

attaining a velocity of 1200 miles per hour. In October of the same year, a similar model was demonstrated in free flight with a thrust greater than its aerodynamic drag. A replica of this vehicle is on exhibit in the Smithsonian Institution.

The original test vehicle embodying the ramjet engine went through various phases of development. Diameters increased from six to thirty inches. Research also concentrated on such items as aerodynamics, propulsion, radar, guidance, control systems, launching, warheads, structure, simulation and ground and flight-testing. A new means of fuel and airflow controls was designed, thereby enabling the first simple model to be developed into present types, which

have a much higher degree of thrust control and provide the propulsion plant of the Talos missile. While Bumblebee also developed other guided missiles, such as the Terrier and the Tartar, the ramjet engine itself was placed in a special division and called the Talos program.

Guiding the supersonic missiles is a pair of super radars that can pick up targets many miles beyond the horizon



The name Talos, taken from a mythological character, is appropriate for a weapon whose mission is to defend the nation. King Midas of Crete asked Zeus, the father of the gods, for someone to defend his island domain. Zeus in turn asked Hephaestus, god of metalsmiths, to supply him with a suitable defender. Hephaestus made Talos, a living brass demigod, who walked about the island three times a day to ward off any would-be attackers from the sea. Nearly indestructible, Talos had his "Achilles' heel" that proved his undoing. He had one vein that was plugged with a rivet in his foot. The resourceful enchantress Medea magically drew out the rivet and poor Talos bled to death.

Talos Is Versatile, Awesome

Propelled at supersonic speeds and guided by remote-controlled aiming, the Talos missile almost infallibly destroys an oncoming attack at distances up to 65 miles. While primarily a surface-to-air missile, it is sufficiently versatile to be used as a surface-to-surface missile in shore bombardment as well. While it is conceivable that some defensive measures against Talos will be developed, the missile is presently an awesome weapon in our national-defense arsenal.

The weapon has already set a new level in the size and performance of solid-fuel booster rockets. It was the first missile to employ a dual-guidance system, accurate at both short and long ranges. The Talos program has also pioneered the introduction of atomic warheads to anti-aircraft missiles. Adm. Arleigh Burke, chief of naval operations, has called it "the best missile in any arsenal in the world."

The Talos missile now in production weighs 3000 pounds and is approximately 20 feet long and 30 inches in diameter. Its 40,000-horsepower ramjet engine enables it to maintain a level-flight altitude higher than that reached by any bomber. It is accelerated to supersonic speed by a solid-fuel rocket propellant about 10 feet long. This booster is jettisoned when the missile reaches cruising speed. Here the ramjet engine takes over.

Like an Automobile Carburetor

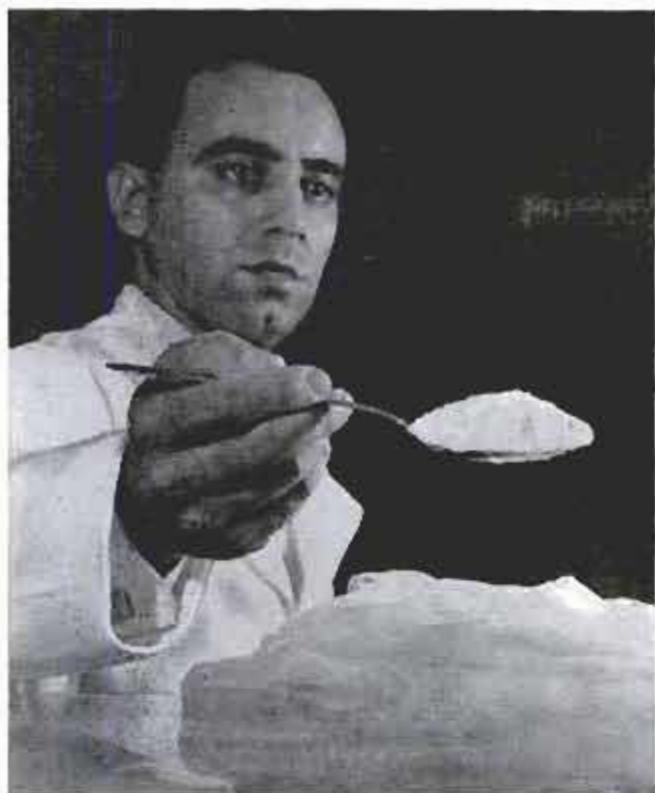
Unlike a turbojet, the Talos propulsion unit does not require a complex and expensive compressing unit to inject large quantities of air for the combustion of the



At a battle station below decks on the *Galveston*, a gunner's mate inspects the end of one of the supersonic ramjet "birds"

Talos fuel (kerosene). In the ramjet the motion of the missile itself serves to compress the air that enters from the front. The Talos needs only 10 to 15 percent of the fuel load a rocket would need to develop the same thrust for the same length of time. Further, variations in the rate of fuel injection determine the speed and thrust of the missile, somewhat as a carburetor does in an automobile.

There are two phases to the direction of the weapon toward its target. Initially there is a beam-type guidance from the launching point to the target area. Guidance here is supplied from the launching area, where information on the presence of hostile targets is available by radar. In the second phase, control shifts from beam guidance to homing guidance. The control systems contain the latest applications of etched-circuit wiring and modular packaging to missile design. A safety and economy measure is the Talos Tactical Test Equipment (Tatte), which electronically records and reveals through flashing red and green lights whether each component is functioning properly prior to firing the weapon. Whether the Talos is equipped with atomic or conventional warheads, a proximity fuse sets off the warhead when it is within range of the target. ★ ★ ★



Powder Suspends Particles in Tube of Water

One tablespoon of a new white powder added to a tube of water suspends golf balls at various levels in the tube. The powder

is expected to have wide uses in industry and may eliminate the "shake well before using" label from many bottles.

Tower for Newlyweds

Honeymooners will have a new view of Niagara Falls. A 270-foot observation tower is being built at the foot of the falls. The tower, with green-tinted glass walls, will have an elevator reaching six observation decks.

Tank Car Is Tornado Shelter

What can you do with old railway tank cars? Gerald Federgreen of Topeka, Kans., bought a tank car section and had it buried in his front yard as a tornado shelter. It will accommodate about 25 adults. Cost of the shelter was about \$250.



POPULAR MECHANICS presents its Seventh Annual Automotive Section, your yearbook of the industry. It features a full-color tribute to four motoring epics—four events that dramatize the almost insane determination of pioneers to prove the automobile's reliability. Other articles range from a conversation with the industry's top stylists to a proposal by an industrial designer for a small, economical car for the shopper-commuter. Also, as usual, there is a complete listing of all 1959 cars plus the most popular imported models.

1895 to 1908:

HEROIC YEARS OF THE AUTOMOBILE

Text by Arthur R. Railton, Automotive Editor

Paintings by PM Artist Robert C. Korta

THIS IS THE STORY of heroes—human and mechanical. The story of brave, indomitable men who trusted beyond reason, the mechanical wonder of their time, the automobile.

The motorcar had scarcely been built before these visionaries realized that it was destined to break down geographical barriers. With it, men could go anywhere and they were determined to prove it. Beginning in 1895 with an unbelievable 732-mile race in France, and ending in 1908 with the greatest motoring adventure of all, the race from New York to Paris around the world, these years were the automobile's most heroic.

To those pioneers who believed in the automobile and its future, *Popular Mechanics* dedicates these paintings.

PM acknowledges with thanks the help of the Automobile Manufacturers Association and the Automotive History Collection of the Detroit Public Library in the preparation of this feature.

READY-TO-FRAME REPRINTS AVAILABLE

Full-color reprints of these four paintings of the automobile's heroic years are available (unfolded and printed on one side only). Send 25 cents in coin to the Bureau of Information, *Popular Mechanics Magazine*, 200 East Ontario, Chicago 11



1903 . . .

First Coast-to-Coast Drivers: Jackson and Crocker

WHEN THE vacationing Dr. H. Nelson Jackson heard some men in San Francisco's University Club agree that it would be impossible to drive a car across the continent, he decided to try it—he had to be getting back to his home in Vermont anyway.

He bought a 1903 Winton, added an extra gas tank, piled on some camping equipment and four days later, on May 23, 1903, he and a mechanic, Sewall K. Crocker, left for New York.

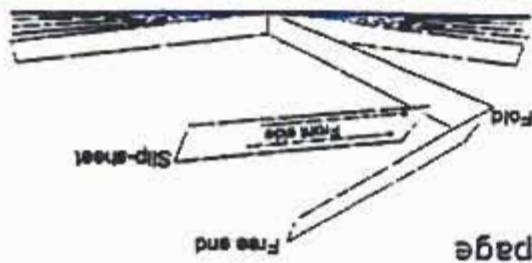
They drove north to Oregon, east across the alkaline wastes of the Great Desert. So irritating was the alkali dust that they had to equip their dog with goggles. (Painting shows Jackson driving across canvas spread over a soft spot in the sand to provide traction.)

Once through the desert, heavy rains made frequent use of block and tackle necessary. Except for this (and an occasional horse tow), the Winton made the trip unaided.

Fuel was a problem as only enough for 300 miles could be carried. Once Crocker walked 30 miles for gasoline. Breakdowns were minor and the ingenious mechanic improvised repairs when necessary.

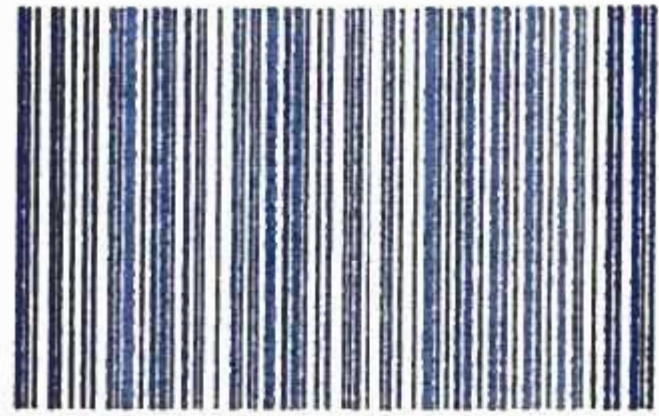
The pair arrived in New York without fanfare 64 days after starting out, beating by almost a month a much publicized, factory-organized trip by the Packard, Old Pacific.





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Inverted Foldout slip-sheet



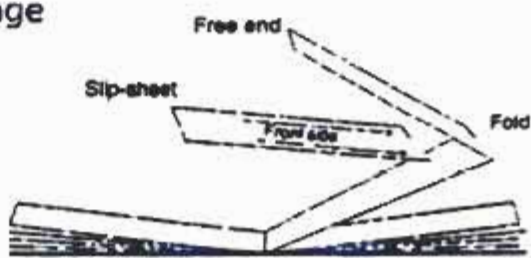
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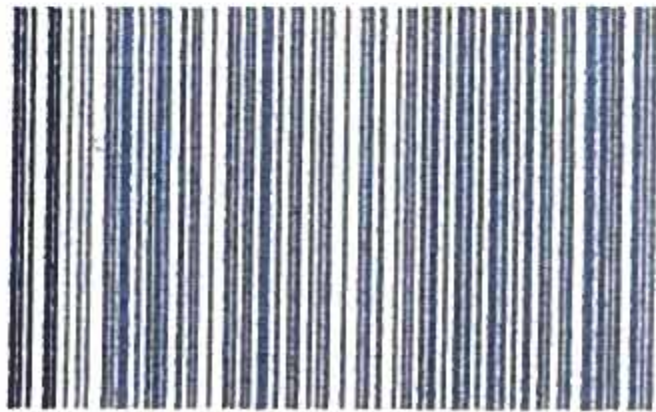
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1907 . . .

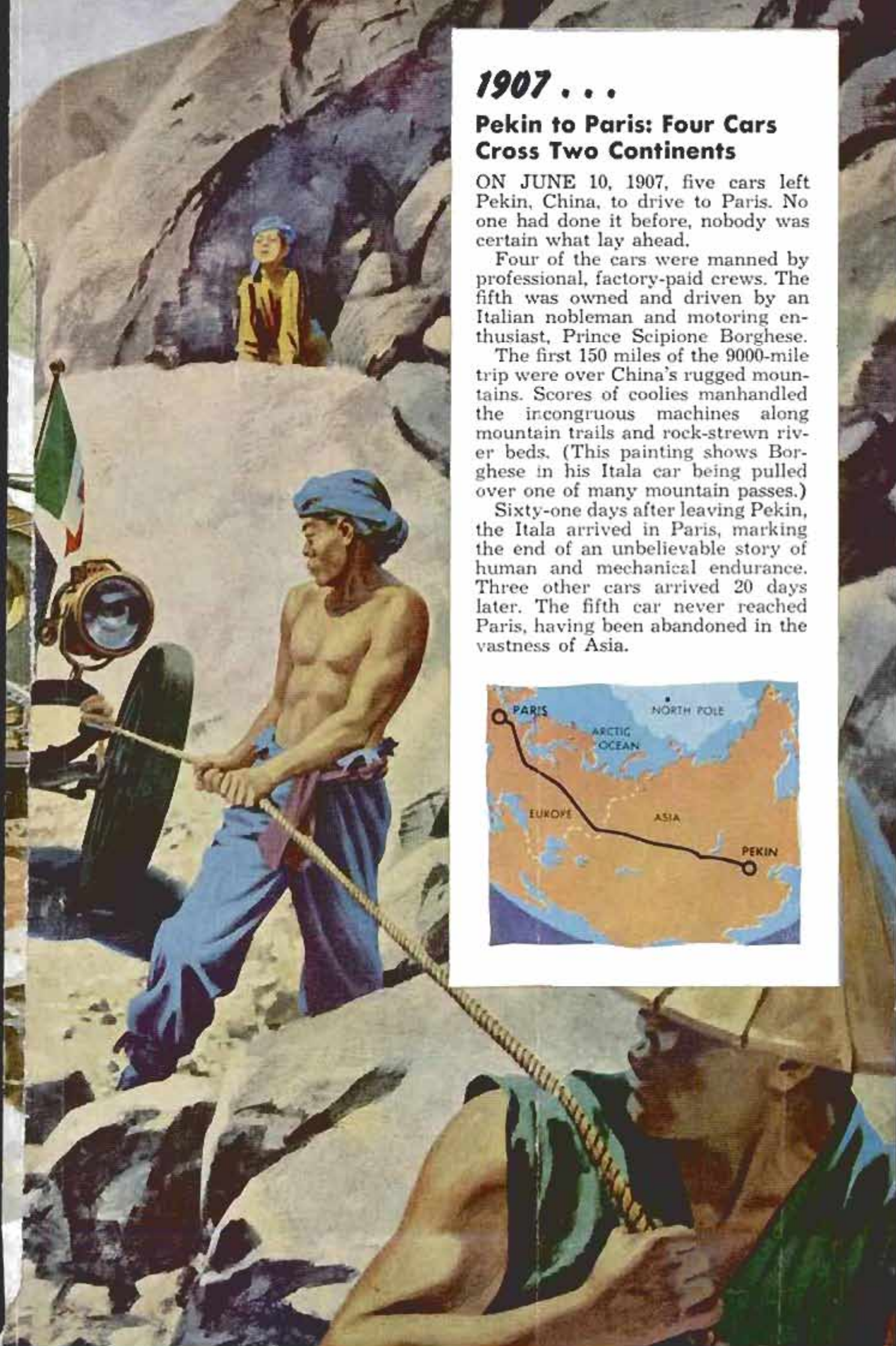
Pekin to Paris: Four Cars Cross Two Continents

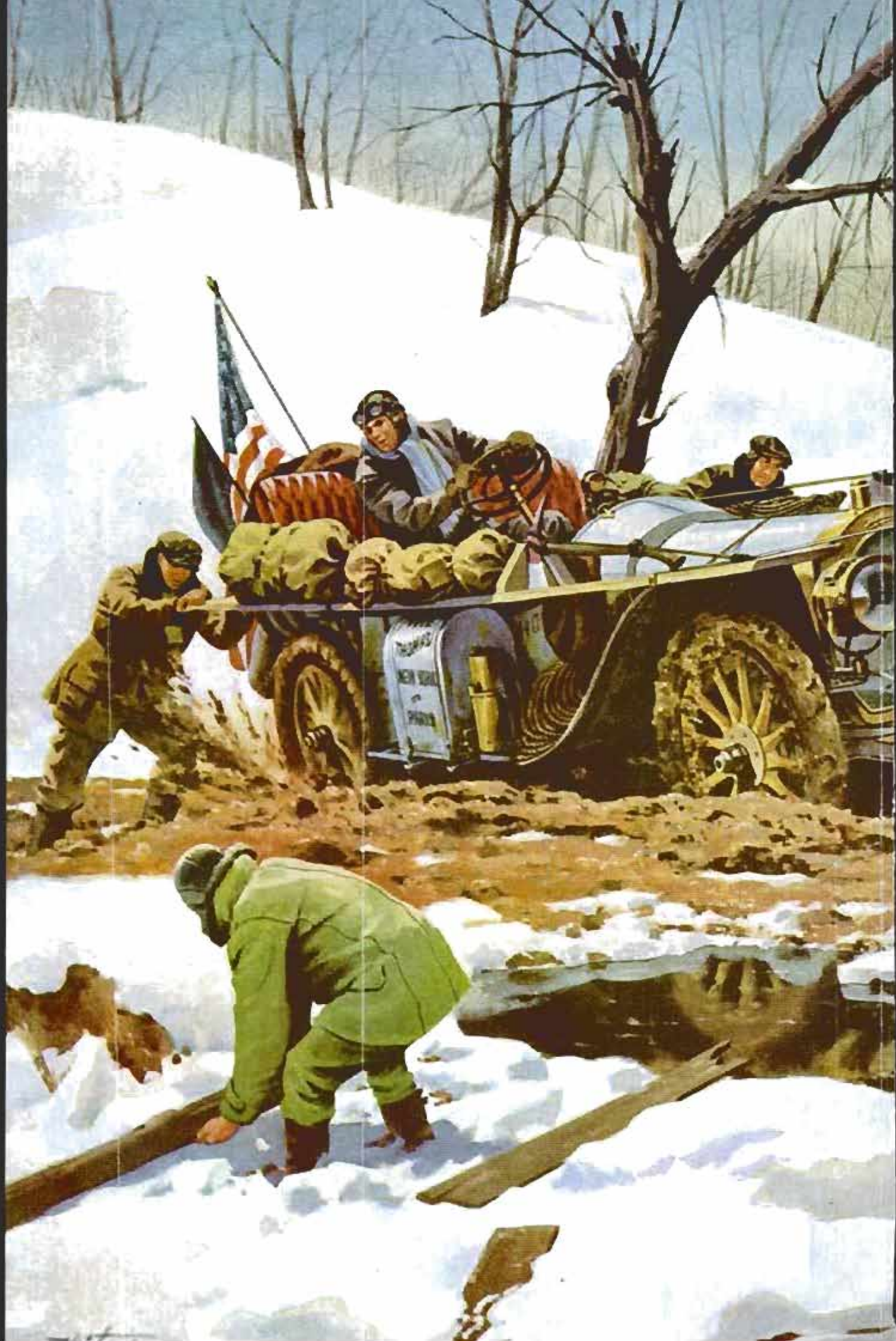
ON JUNE 10, 1907, five cars left Peking, China, to drive to Paris. No one had done it before, nobody was certain what lay ahead.

Four of the cars were manned by professional, factory-paid crews. The fifth was owned and driven by an Italian nobleman and motoring enthusiast, Prince Scipione Borghese.

The first 150 miles of the 9000-mile trip were over China's rugged mountains. Scores of coolies manhandled the incongruous machines along mountain trails and rock-strewn river beds. (This painting shows Borghese in his Itala car being pulled over one of many mountain passes.)

Sixty-one days after leaving Peking, the Itala arrived in Paris, marking the end of an unbelievable story of human and mechanical endurance. Three other cars arrived 20 days later. The fifth car never reached Paris, having been abandoned in the vastness of Asia.





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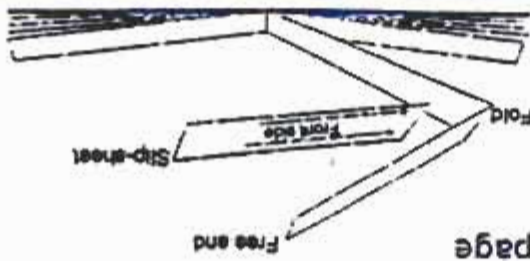
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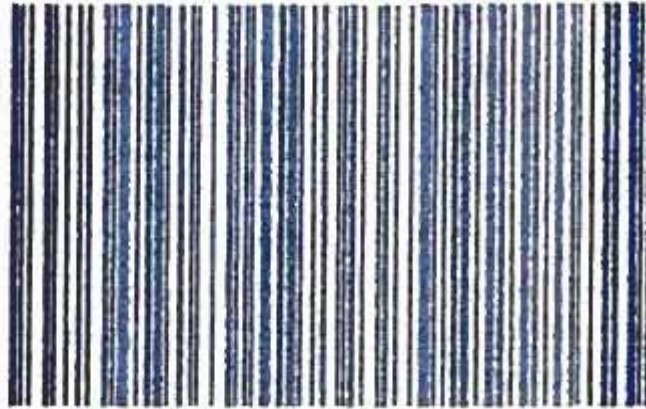
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Inverted Foldout slip-sheet



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1895 . . .

Paris - Bordeaux - Paris: Levassor's Triumph

NO MAN did more for the automobile than the Frenchman, Emile Levassor. He, more than any other person, "invented" the motor car.

But his most heroic achievement took place in 1895 when he drove a car of his own design from Paris to Bordeaux and back, a distance of 732 miles, in 48 hours and 48 minutes.

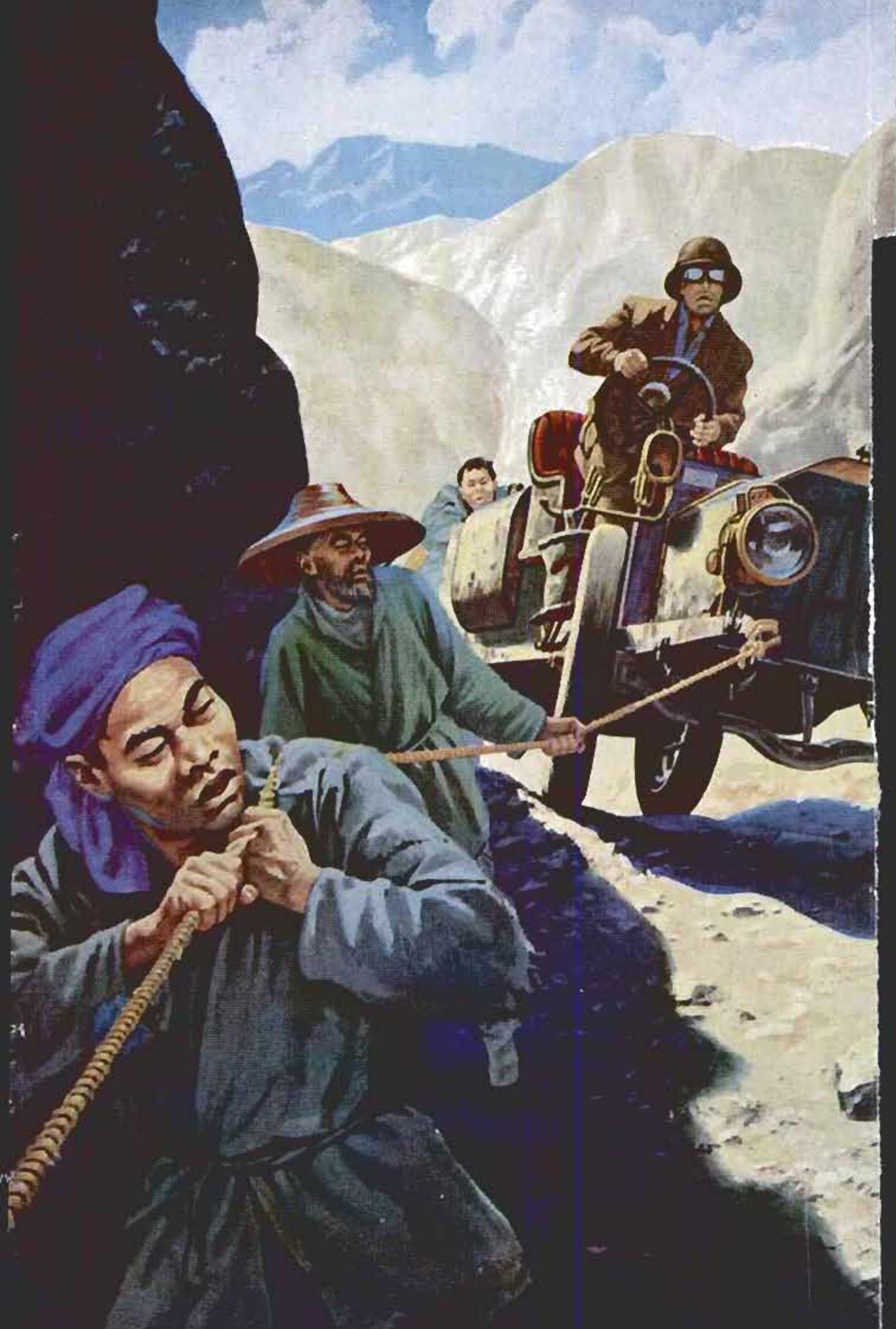
This first speed event of all time proved the superiority of the gasoline engine. Twenty-one vehicles started—14 gasoline-powered, 6 steam and 1 electric. Only nine finished within the 100-hour limit. Of these, eight were gasoline cars. The one steamer finished ninth, 41 hours behind the winner.

Levassor drove all the way without relief. He had planned to turn over the tiller to a relief driver at Ruffec on the way to Bordeaux, but he went so fast that he reached Ruffec several hours ahead of time. The relief driver was not ready. Not wanting to lose time, he drove on, arriving at Bordeaux in the middle of the night and immediately started back. On his return through Ruffec, he picked up the relief driver (who was ready this time) but, refreshed by the prospect of victory, Levassor insisted on driving all the way.

The scene shown here is his triumphant arrival at the finish line on the Boulevard Maillot in Paris.







1908 . . .

Race Around the World: New York West to Paris

IT WAS INEVITABLE after Pekin-Paris and the next year it happened. The automobile was to roll around the world. Never has anything so big, so potentially dangerous, been so poorly planned. It was a debacle from start to finish. But the courage of determined men and the indestructibility of the machines they drove made the misadventure important in automotive history.

February 12, 1908, six cars left New York to drive west to Paris, all the way by land, hoping to cross the Bering Straits on frozen ice. Maniacal as it sounds, the men believed the trip possible although no reconnaissance had been made. They discovered, of course, the grand plan was a tragic blunder. Months later, three of the cars arrived in Paris by the substitute route shown on the map. Winner was the American Thomas, shown here mired in the sticky mud of Indiana early in the race.





**DETROIT
LISTENING POST**

By
Art
Railton

1959

PARADE OF CARS

IT WAS a year of decision—a year in which major decisions had to be made, decisions that will set the course of the industry for years ahead.

Some were made, others postponed until the industry is more certain what you, the public, think. That makes 1959, *your* year of decision.

It was a year for drawing the line—the little foreign cars went as far as they could be permitted to go. At one period in the year, they were selling 11 percent of the total market. That did it. The big boys decided to get into the game.

Before the 1959 World Series is over, you will be admiring the all-new domestic small cars as they scoot around the streets of your town.

What will this new breed of American cars be like? Nobody is saying for sure, but it certainly will be handsome, it certainly will be economical, and it certainly will sell.

But there was more to 1958 than the small-car decision.

Most important (and most frightening) item in 1958 was the sharp drop in sales of new cars. Total industry sales were down about 30 percent. Some makes were down twice that much. Obviously, this must be stopped if the industry is to maintain its present stature.

Detroit experts blame the sales lag on the recession. Some critics outside the industry put the blame in a different order: They argue that the excessive opulence of the 1958 cars so out-priced the average

American that he couldn't buy a new model or, if he could buy it, he was so sickened by the excesses of the machines that he wouldn't buy. This, these critics claim, created the recession.

So the argument deteriorated into "which came first" and as with the hen and the egg, nobody knew.

Meanwhile in South Bend, Indiana, where gloom had been hip-deep for years, the fast-weakening, almost desperate Studebaker-Packard Company came up with the biggest news story of 1959: A small American car that could make critics eat their words.

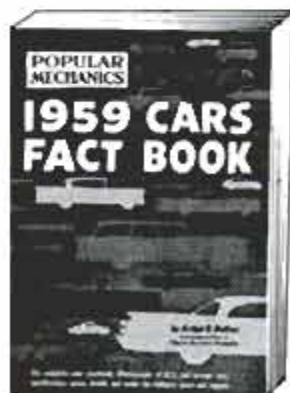
This new car, the Lark, is a mere foot longer than the tiny foreign cars and yet seats six (snugly, to be sure). It has a good, old-fashioned American water-cooled engine. It comes as a six or a V8, and the V8 is a scat-wagon in the best American tradition. It has a trunk in the back where the bellhop has learned to expect it.

How the public is taking to this car is uncertain at this writing (late November), but expectations are great. Not only South Bend, but Detroit also, is watching, because its reception will provide valuable information about other small cars' prospective sales.

Only two cars set sales records in 1958: The Rambler (with the help of its new and smaller brother, the American); and the expensive Thunderbird.

Two more different cars would be hard to find. The only quality they share is dimensional. Both are smaller than other cars in their price classes. Yet the men who designed the Thunderbird do not credit the car's smallness with its success (see page 176). "Small" continues to be a verboten word in the industry. American Motors still isn't bold enough to use it in describing its Ramblers. (Even the current Studebaker Lark makes no mention of the car's smallness, describing it instead as a "new dimension in motoring.")

There just weren't enough Thunderbirds to satisfy the orders, so meteoric was its success. In its first year as a full-size car (with four seats, that is), the Thunderbird



PM's 1959 Cars Fact Book is off the press with 160 pages about domestic and foreign cars. Written by Arthur R. Railton, *PM's* Auto Editor, it discusses the new cars in an adult, informative manner. Get a copy at your newsstand for 75 cents or send 85 cents to *Popular Mechanics*, 200 E. Ontario, Chicago 11

What's under the sheet metal?

On the next 17 pages are photographs of all 1959 American cars and many European makes. In addition, there are drawings which show what the sleek, shiny metal hides: The frame; the suspension and running gear. These are the parts that make a car behave the way it does; these are the parts that most people never see.

Among the American cars there is considerable variation in frame design, less in running gear, and little or none in engines. European cars are more varied. They range from front engine, front-wheel drive to rear-engine, rear-wheel drive; from water to air-cooled; from two to three to four cylinders; from torsion bars to transverse leaf springs to horizontal coil springs.

The sketches are self-explanatory. The white arrow on each foreign chassis points to the front of the car. The small "X" inside the square on the American cars locates the universal joints in the drive shafts. Beneath each sketch is pertinent descriptive material.

took 22 percent of the prestige-car market. It sold more than twice as many cars as Imperial and about 25 percent more than Lincoln. Yet, says Ford, the smallness of the car has nothing to do with its success.

The Rambler American, a revival of a 1955 design, outsold even the most optimistic hopes of its sponsors. Not spectacular in either looks or performance, it is small, neat and practical—and it sells.

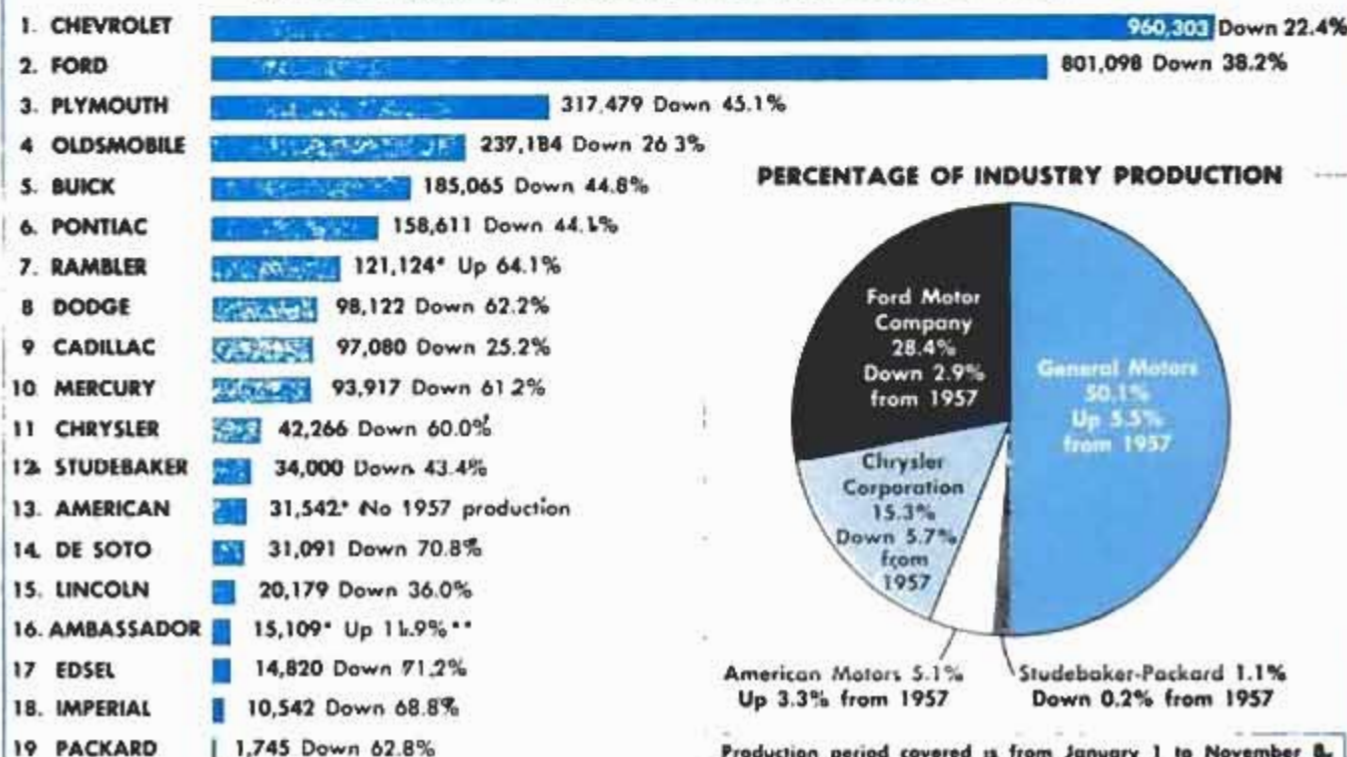
Among most of the new cars for 1959,

stylists were king. The engineer was in a hiatus between last year's achievements and the big promises for 1960.

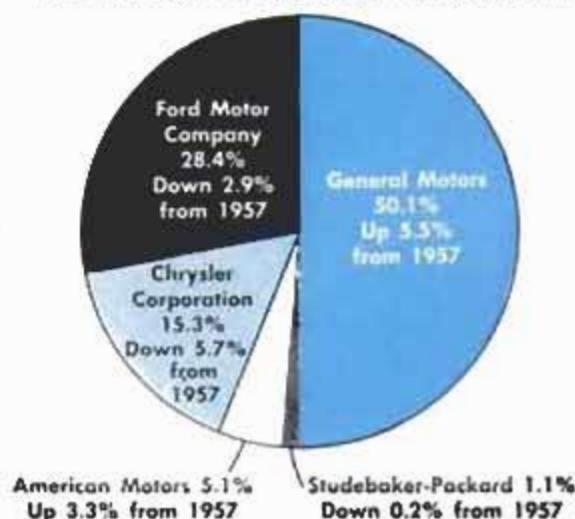
The exciting advances of the 1958 models somehow seem less exciting one year later. Air suspension, introduced as the greatest thing since independent front suspension, failed to attract a market. It was too expensive, too temperamental, too marginal. The public didn't get excited about it.

(Continued to page 294)

PRODUCTION OF PASSENGER CARS DURING 1958



PERCENTAGE OF INDUSTRY PRODUCTION



* Approximate ** Compared to 1957 Hudson-Nash total
TOTAL FOR INDUSTRY: 3,270,877 passenger cars—Down 36.8% from 1957

Production period covered is from January 1 to November 8, 1958, and comparisons are with same period of 1957. Total production for 1958 is expected to be about 4,520,000 cars. Data by courtesy of Automotive News



AMERICAN

Wheelbase: 100.0 inches
 Leaf springs, rear
 Solid rear axle
 Drive through rear springs
 Unit body-frame
 One-piece exposed drive shaft
 Coil springs, independent front suspension
 Six-cylinder engine only

American, unlike other members of the American Motors family, has an exposed drive shaft and leaf springs at the rear in the normal Hotchkiss arrangement. Drive is through the rear springs, no torque tube being used. Front suspension is by coils as with the other American Motors products. It is entirely conventional except that the coil springs extend higher than in the usual design. The unitized body and frame eliminates the necessity for side rails.



Six-Cylinder Two-Door	Lowest Priced	Displacement	Shipping Weight	Over-All Length	Over-All Width	Trunk Space	
AMERICAN	\$1835	195.6	2476	178.3	73.0	8.2	
STUDEBAKER	\$1925	169.6*	2597	175.0	69.0	12.6	
	Turn Circle	Legroom		Headroom		Hiproom	
		Front	Rear	Front	Rear	Front	Rear
AMERICAN	36.0	44.0	37.5	35.3	34.0	58.0	45.3
STUDEBAKER	37.5	44.0	41.0	36.0	35.0	59.5	59.0

*259.2-cu.-in. V8 also available.



Leaf springs, rear
 Solid rear axle
 Drive through rear springs
 Ladder frame
 One-piece exposed drive shaft
 Coil springs, independent front suspension
 V8 or Six-cylinder engine
Wheelbase: 108.5 inches

Studebaker Lark's box-section frame is of heavier gauge than its previous models and being shorter, also, is about 30 percent more rigid. Actual frame design is unchanged except for the shortening to allow the smaller wheelbase. Rear suspension is conventional with semielliptical leaf springs that take the thrust of the exposed drive shaft in the normal Hotchkiss manner. Front suspension is by coils. These springs are designed to have a variable rate so stiffness varies with the amount of load. The ladder-type frame has a slight belly for increased rear-seat legroom.

STUDEBAKER





4-Door Sedan Data	Lowest Priced	Standard V8 Displacement	Shipping Weight	Over-All Length	Over-All Width	Trunk Space	Turn Circle
PLYMOUTH	\$2402*	318.0	3430	208.2	78.0	35.6	42.2
CHEVROLET	\$2419*	283.0	3614	210.9	79.9	19.2	40.2
FORD	\$2391*	292.0	3485	208.0	76.6	33.9	40.6
RAMBLER	\$2398*	250.0	3287	191.2	72.2	13.5	37.6

*V8s only, for Sixes subtract about \$120



PLYMOUTH



Wheelbase: 118.0 inches

Leaf springs, rear
Solid rear axle
Exposed drive

Ladder frame
One-piece drive shaft
Drive through rear springs

Torsion bars, front
Independent front suspension
V8 or Six engines

Plymouth's straight-railed ladder frame is typical of the Chrysler line. Front-end springing is by torsion bars which, for 1959, have been thinned and shortened thanks to improved metallurgy. Rear suspension is Hotchkiss with conventional leaf springs. A change in the roof of hardtop sedans has given added rear-seat headroom and better seat padding over the drive-shaft tunnel.



Wheelbase: 119.0 inches

Coil springs, rear
Solid rear axle
Exposed drive

X-frame
Two-piece drive shaft
Drive through control arms

Coil springs, front
Independent front suspension
V8 or Six engines

Chevrolet keeps its bodies low by using a two-piece drive shaft with its center joint inside the tubular midsection of the X-frame. Coil springs at the rear make necessary a set of control arms to transmit thrust from the rear wheels to the frame. The narrow-waisted frame permits wide stepdowns in the rear floor. Coil springs are mounted conventionally at the front end.

Legroom		Headroom		Hiproom	
Front	Rear	Front	Rear	Front	Rear
45.5	41.5	35.7	34.2	63.0	62.7
45.0	42.8	36.1	34.3	66.1	65.5
42.7	40.3	33.5	33.3	60.4	60.8
43.0	40.0	36.0	35.0	59.8	60.1

LOW PRICE

FORD



Wheelbase: 118.0 inches

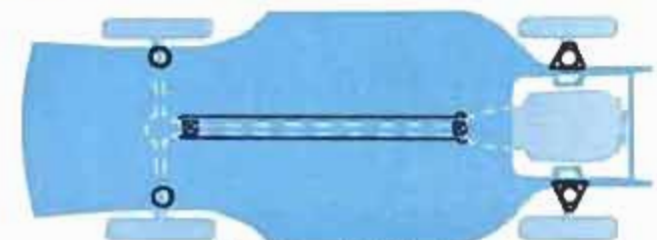
Leaf springs, rear
Solid rear axle
Exposed drive

Ladder frame with cow belly
One-piece drive shaft
Drive through rear springs

Coil springs, front
Independent front suspension
V8 or Six engines

Ford makes room for rear foot wells by giving its ladder frame a broad belly. The added width makes room for lowering the floor inside the side rails. Drive shaft is of one piece. Front and rear suspensions are conventional with coils in front and semielliptical leaf springs in the rear. The rear end is a standard Hotchkiss setup with wheel thrust being transmitted through the leaf springs.

RAMBLER



Wheelbase: 108.0 inches

Coil springs, rear
Solid rear axle
Torque-tube drive

Unit body-frame
One-piece drive shaft
Drive through torque tube

Coil springs, front
Independent front suspension
V8 or Six engines

Rambler's unit body eliminates the conventional side rails. Thrust from the rear wheels is taken through the torque tube that connects the transmission and rear axle. Within it, the drive shaft rotates. Coil springs are used on all wheels and no control arms are necessary because of the torque tube. Front-end suspension is conventional. The unit body permits the floor to be lowered without rail problems.



4-Door Sedan Data	Lowest Priced	Standard V8 Displacement	Shipping Weight	Over-All Length	Over-All Width	Trunk Space	Turn Circle
PONTIAC	\$2704	389.0	3940	213.7	80.7	19.0**	42.7
AMBASSADOR	\$2587	327.0	3428	200.2	72.2	13.5	39.8
DODGE	\$2707*	326.0*	3615	217.4	80.0	38.6	43.6
EDSEL	\$2684*	292.0**	3675	210.9	79.8	32.0	41.8

* V8s. Dodge Six \$2587, Edsel Six \$2600

** Catalina, Star Chief and Bonneville 220.7 length, 24.3 trunk space

* Coronet, Royal and Custom Royal 361.0

** Ranger, Corsair 332.0



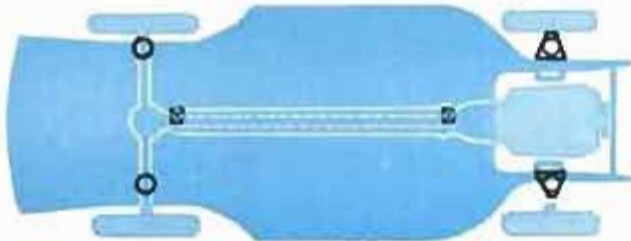
PONTIAC



Wheelbases: 122.0 and 124.0 inches

- | | | |
|---------------------|----------------------------|---------------------|
| Coil springs, rear | Tubular center | Coil springs, front |
| Solid rear axle | X-type frame | Independent front |
| Exposed drive shaft | Two-piece drive shaft | suspension |
| | Drive through control arms | V8 engine only |

Pontiac's tubular-center X-frame requires no side rails and allows the rear foot wells to be wider than usual. Coil springs suspend all four corners of the body. The two-piece drive shaft has a center universal inside the junction of the frame. At the rear, the coils are mounted ahead of the axle on pivoted control arms that take the thrust of the wheels.



Wheelbase: 117.0 inches

- | | | |
|----------------------|---------------------------|---------------------|
| Coil springs, rear | Unit body and frame | Coil springs, front |
| Solid rear axle | One-piece drive shaft | Independent front |
| Enclosed drive shaft | Drive through torque tube | suspension |
| | | V8 engine only |

AMBASSADOR

Ambassador shares the same chassis layout as the smaller Rambler (but differs from the American). It has coil springs all around and a torque tube takes up the drive and torque. The drive shaft, rotating inside the tube, is one piece. At the front, conventional coil springs are used, but mounted higher than is customary due to the unit design that eliminates side rails.

Legroom		Headroom		Hiproom	
Front	Rear	Front	Rear	Front	Rear
44.8	42.5	34.8	33.9	65.4	65.4
43.0	40.0	36.0	35.0	59.8	60.1
45.5	42.5	35.7	34.5	63.0	62.7
42.8	40.4	33.8	33.5	60.4	60.8

LOWER



Wheelbase: 122.0 inches

- | | | |
|---------------------|----------------------------|---------------------|
| Leaf springs, rear | Ladder frame | Torsion bars, front |
| Solid rear axle | One-piece drive shaft | Independent front |
| Exposed drive shaft | Drive through rear springs | suspension |
| | | Six and V8 engines |

Dodge has a straight-through ladder frame that is typical of Chrysler products and that makes impossible the use of rear-seat foot wells. Front suspension is by torsion bars that run longitudinally. At the rear, the suspension uses semielliptical leaf springs. The one-piece exposed drive shaft is conventional Hotchkiss design and thrust is taken through the rear springs.

DODGE



Wheelbase: 120.0 inches

- | | | |
|---------------------|----------------------------|---------------------|
| Leaf springs, rear | Ladder frame | Coil springs, front |
| Solid rear axle | One-piece drive shaft | Independent front |
| Exposed drive shaft | Drive through rear springs | suspension |
| | | Six and V8 engines |

Edsel has a ladder frame but, like Ford, it incorporates a billowing cow belly that allows clearance for rear-seat foot wells. Its front suspension is conventional with coil springs and wishbones. Rear suspension, too, is conventional with semielliptical leaf springs that take the drive and torque from the one-piece exposed drive shaft in a standard Hotchkiss-drive manner.

EDSEL



4-Door Sedan Data	Lowest Priced	Standard V8 Displacement	Shipping Weight	Over-All Length	Over-All Width	Trunk Space	Turn Circle
BUICK	\$2804	364.0*	4229	217.4**	80.7	15.0	44.0
DE SOTO	\$2904	361.0*	3670	215.5**	78.7	37.5	43.6
OLDSMOBILE	\$2902	371.0*	4162	218.4**	80.8	17.6	45.0
MERCURY	\$2832	312.0*	4001	217.8**	80.7	31.5	44.0

* LeSobre Invicta and Electro 401.0
 ** Electro 220.6, Electro 225, 225.4

† Firesweep Fireflite and Firedome 383.0
 †† Firesweep Fireflite 219.5, Firedome 221.1

* "88" Super 88 and "98" 394.0
 ** "98" 223.0



BUICK



Wheelbases: 123.0 and 126.3 inches

Coil springs, rear Ladder frame with Coil springs, front
Solid rear axle K-member Independent front
Enclosed drive Two-piece drive suspension
shaft shaft V8 engine only
Drive through torque tube



Wheelbases: 122.0 and 126.0 inches

Leaf springs, rear Ladder frame Torsion bars, front
Solid rear axle One-piece drive Independent front
Exposed drive shaft suspension
shaft Drive through V8 engine only
rear springs

DE SOTO

De Soto has a straight-through ladder frame like all Chrysler Corporation cars. Its independent front suspension is with longitudinal torsion bars that are shorter and thinner this year as a result of the improved metals. Rear suspension is with standard semielliptical leaf springs that take the wheel thrust in Hotchkiss fashion. The exposed drive shaft is in one piece.

Legroom		Headroom		Hiproom	
Front	Rear	Front	Rear	Front	Rear
44.6	42.6	35.7	34.2	66.1	65.5
45.5	43.0	35.7	34.5	63.0	62.7
44.8	42.5	34.9	34.2	66.1	65.5
44.3	43.6	33.2	32.9	62.5	62.8

*Monterey Montclair 383.0 Park Lane 430.0

**Park Lane 222.8



Wheelbases: 123.0 and 126.3 inches

Leaf springs, rear Ladder frame with Coil springs, front
Solid rear axle X-member Independent front
Exposed drive Two-piece drive suspension
shaft shaft V8 engine only
Drive through rear springs

UPPER MEDIUM OLDSMOBILE

Oldsmobile combines an X-frame and a ladder frame (most cars with ladder frames use X-bracing on convertible bodies only). It also has a cow belly to allow for the step-down floor in the rear. Front coil springs are conventional as are the semielliptical leaf springs at the rear end. Its two-piece drive shaft has the center universal joint mounted within the tunnel.



Wheelbases: 126.0 and 128.0 inches

Leaf springs, rear Ladder frame Coil springs, front
Solid rear axle One-piece drive Independent front
Exposed drive shaft suspension
shaft Drive through V8 engine only
rear springs

MERCURY

Mercury's ladder frame with a bowed center portion to give foot-well space in the rear has an unusual cross member at the rear axle. It is a wide, arched bracing and gives great lateral strength without taking up much vertical space. Front suspension by coils and rear by long leaf springs are both conventional. Drive shaft is one piece and its setup is Hotchkiss.



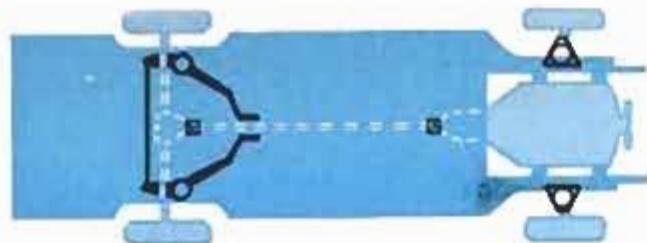
4-Door Sedan Data	Lowest Priced	Standard V8 Displacement	Shipping Weight	Over-All Length	Over-All Width	Trunk Space	Turn Circle
LINCOLN	\$5090	430.0	4986	227.1	80.1	17.2	45.0
CADILLAC	\$5080	390.0	4835	225.0	80.2	19.3	47.0
CHRYSLER*	\$4424	413.0	4120	220.9	79.5	37.5	47.1
IMPERIAL	\$5016	413.0	4735	226.3	81.0	36.7	48.2

* New Yorker series

All have automatic transmission, power brakes and steering standard.



LINCOLN



Wheelbase: 131.0 inches

Coil springs, rear
Solid rear axle
Exposed drive

Unit body-frame
One-piece drive shaft
Drive through trailing arms

Coil springs, front
Independent front suspension
V8 engine only

Lincoln's unitized body (probably the largest in the world) eliminates the conventional frame and its restrictive side rails. Front suspension is conventional with coil springs and wishbones. The drive is through an exposed propeller shaft with no center universal. Trailing arms that carry the rear coil springs are attached to a body cross member at their forward ends. A track bar is mounted behind the rear axle.

CADILLAC



Wheelbase: 130.0 inches

Coil springs, rear
Solid rear axle
Exposed drive

Tubular center X-frame
Two-piece drive shaft
Drive through four links

Coil springs, front
Independent front suspension
V8 engine only

Cadillac's tubular-center X-frame eliminates the problem of the restrictive side rails and allows rear floor wells to be wider. The exposed drive shaft is in two sections with its center universal joint inside the frame's narrow waist. The rear section of the shaft is rubber cushioned. Coil springs support the rear of the body and mount ahead of the axle on trailing arms. Front suspension is conventional with coil springs.

Legroom		Headroom		Hiproom	
Front	Rear	Front	Rear	Front	Rear
44.1	46.1	34.9	33.7	61.0	65.5
45.6	45.3	34.8	33.2	64.6	64.4
45.5	43.0	35.7	34.5	63.0	62.7
45.5	46.5	36.2	34.2	61.0	60.2

HITCH RICE

CHRYSLER



Wheelbase: 126.0 inches

Leaf springs, rear
Solid rear axle
Exposed drive

Ladder frame
One-piece drive shaft
Drive through rear springs

Torsion bars, front
Independent front suspension
V8 engine only

Chrysler's front wheels are sprung by two longitudinal torsion bars anchored to a frame cross member that supports the transmission. Although the drive shaft remains one piece, tunnel height has been reduced by changing to a stepped-diameter shaft that is narrower at the end, fatter in the middle, requiring less bounce clearance. Leaf springs are used in the Hotchkiss-drive rear end.

IMPERIAL



Wheelbase: 129.0 inches

Leaf springs, rear
Solid rear axle
Exposed drive

Ladder frame
Two-piece drive shaft
Drive through rear springs and struts

Torsion bars, front
Independent front suspension
V8 engine only

Imperial, like other Chrysler products, has torsion bars for its front suspension. This year its frame is slightly different from that used by Chrysler. Also different is the two-section drive shaft with its center universal being mounted on a frame cross member. The rear suspension is conventional Hotchkiss with the thrust being taken through longitudinal leaf springs.

For the Young in Heart:



CORVETTE

Here's the only true sports car stamped "Made in U.S.A." Refined steadily since 1953, it is now among the best in the world. It has coils in front, leaf springs in back. New are radius rods that take the torque reactions of the rear axle, relieving the rear springs of the job. Four-speed gearbox has a reverse lockout.



CHRYSLER 300E

Not a sports car in the nimble sense of a Corvette, the 300E is a high-performance machine that covers long distances at high speed with a maximum of comfort. Interiors are elegant in perforated leather that is cool on the hottest day. Dignified but debonair, it is a car to please those who love to go places in a hurry but feel out of character in a sports car.



SILVER HAWK

THUNDERBIRD

If you want a car that looks like a sports car, and are not particularly anxious for it to be a bomb, the Studebaker Silver Hawk belongs in your garage. Low, long and finned, its small V8 or even smaller Six puts it among the featherweights. But who cares? It is a handsome, pleasant machine.



No sports car, no bombshell, yet this is a car for the young of all ages. And it seems to be proving that as wallets get fatter, cars needn't get bigger. Handsome, luxurious and overwhelmingly youthful, it still is dignified enough to be driven to a Board of Directors' meeting at the First National Bank.

PARADE OF FOREIGN CARS

THE CHART at the bottom of the page tells the story. It describes more graphically than words the spectacular sales rise of foreign cars in this country.

But it doesn't answer the question that still bothers Detroit: *Why* are they selling? It's this that bewilders the industry.

Is it simply size? Economy? Handling ease? If these are all, then Detroit has no worries. It can and will build cars that satisfy these demands.

But there may be something more—something that Detroit can't possibly provide. It may be the glamor of the imported product. It may be the wide variety of styling that enables the buyer to own an economy car that is not a carbon copy of his neighbor's. It may be the variety of engineering (the chassis diagrams on the following pages show how much variety there really is among the imported cars). This variety gives the owner reason to brag about air-cooled engine, swing axles, rack-and-pinion steering, front-wheel drive, trailing-arm suspension, unit body and all the vast cabala of automobile design that seems completely foreign to the American-car buyer.

Whatever the reason, Detroit now realizes that the foreign-car success cannot be ignored any longer. What started out as

a fad for funny fellows with berets has turned into an epidemic. Small foreign cars that were originally bought as second cars apparently are becoming first cars in more and more families.

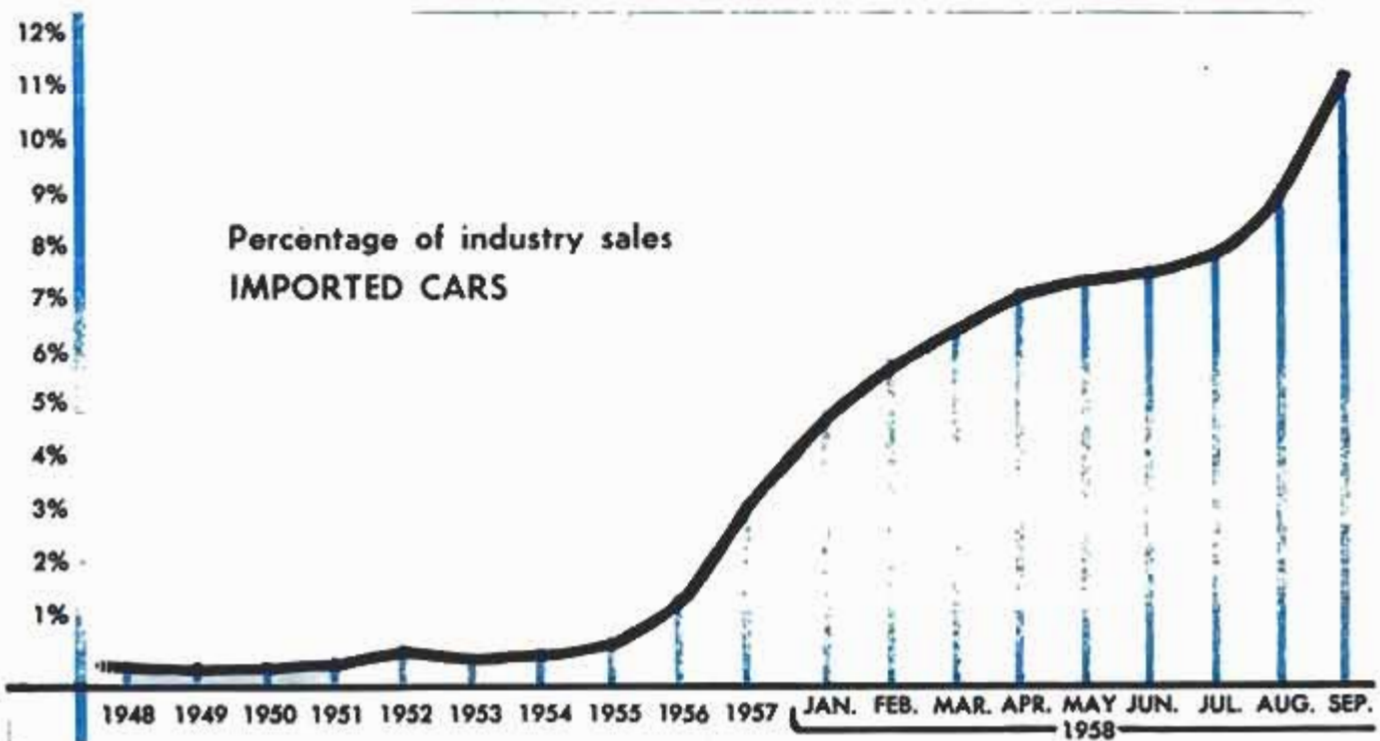
The total foreign-car sales in this country for 1958 were about 275,000 cars, which is equal to the combined 1958-model sales of Chrysler, Edsel, Studebaker, De Soto, Lincoln, Imperial and Packard. And estimates are that 1959 sales will be higher.

Next year, the big American companies will have their small cars in the battle. Actually, these forthcoming small cars will not compete directly with the best-selling foreign cars in either price or size.

The new American small cars will be more like the Borgward and Peugeot in size and price. Cars like Volkswagen, Renault and Fiat (which currently combine to make most of the foreign-car total) will still have the below-\$2000 market to themselves despite the counterattack of the Americans.

Whether the difference between \$1700 and \$2000 (the expected domestic small-car price) will be enough advantage to keep these foreign cars in volume business remains to be seen. In any case, on the following pages are 18 of the best-known foreign cars, the cars that made Detroit admit that it may have been wrong.

Sales of imported cars skyrocketed to 11.5 percent of all cars sold in this country by September 1958





Styling changes on the 1959 Hillman are minor. Its engine has been enlarged for better performance and quieter high-speed operation. Like most British cars, the Hillman is conventional in its chassis design



Wheelbase: 96.0 inches
 Front engine, inline OHV four-cylinder, water-cooled, 57.5 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Nonindependent
Coil springs	Four-speed transmission	Leaf springs
Wishbones	automatic clutch, optional	Solid rear axle
Ball joints	Top speed: About 80 m.p.h.	Rear-wheel drive by exposed drive shaft
Gas mileage: About 25 m.p.g.		

HILLMAN

	Price*	Displacement	Curb Weight	Over-All Length	Over-All Width	Turn Circle	Front Headroom	Front Legroom
HILLMAN MINX	\$1849	91.1	2221	163.0	60.8	34.3	37.8	34.5
FIAT Multipla 600	\$1598	38.6	1610	139.2	57.1	29.0	36.2**	35.4**
FORD ANGLIA	\$1539	71.6	1716	149.8	60.8	34.5	36.0	44.0

* Port-of-entry price at New York City

** Two-door sedan, other data for Multipla model (illustrated)



Wheelbase: 78.8 inches
 Rear engine, inline OHV four-cylinder, water-cooled, 22 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Independent
Coil springs (Transverse leaf spring on sedans)	Four-speed transmission	Semitrailing wishbones with coil springs
Wishbones	Top speed: About 60 m.p.h.	Rear-wheel drive through swing axle
Gas mileage: About 35 m.p.g.		

Fiat makes so many models it covers the whole market. This four-door Multipla wagon is about as roomy as a small car can be. Chassis layout is shown at right. The larger Fiats have their engines in the front, the smaller ones in the rear. All but the very smallest are watercooled

FIAT

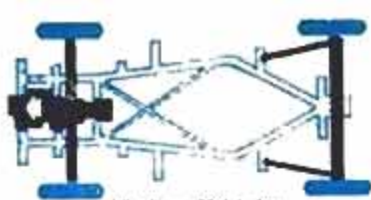


Wheelbase: 87.0 inches
 Front engine, inline flathead four-cylinder, water-cooled, 36 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Nonindependent
Coil springs	Three-speed transmission	Leaf springs
Wishbones	Top speed: About 68 m.p.h.	Solid rear axle
Gas mileage: About 30 m.p.g.		Rear-wheel drive by exposed drive shaft

As you can see at the right, the English Ford has a chassis layout very similar to most American cars (except for the unit body). Shown here is the smallest, the two-door Anglia. Others include the four-door Prefect sedan on the same chassis and several larger and more expensive models

ENGLISH FORD



Wheelbase: 92.6 inches

Front engine, valveless two-stroke, three-cylinder water-cooled, 40 horsepower

Front suspension: Independent Transverse leaf spring	Box-section ladder frame with X-member Four-speed transmission (automatic clutch optional)	Rear suspension: Nonindependent Transverse leaf spring Solid, floating rear axle
Front-wheel drive Rack-and-pinion steering	Top speed: About 80 m.p.h.	
Gas mileage: About 30 m.p.g.		

DKW

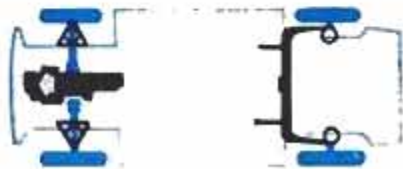


If you like unusual designs, look at the DKW. It has a three-cylinder two-stroke engine with front-wheel drive. Its chassis is so simple and trouble-free that you wonder who decided that cars had to be complicated

	Price*	Displacement	Curb Weight	Over-All Length	Over-All Width	Turn Circle	Front Headroom	Front Legroom
DKW	\$1995	54.7	2075	166.0	66.0	36.0	37.0	N.A.
SAAB 93 B	\$1895	45.6	1806	158.0	62.0	36.0	38.5	36.0
PRINZ NSU	\$1398**	35.6	1137	142.8	57.0	28.0	37.0**	40.0**

* Port-of-entry price at New York City

** Two-door sedan model all other data for Sport Prinz, (illustrated)



Wheelbase: 98.0 inches

Front engine, valveless two-stroke, three-cylinder, water-cooled, 38 horsepower

Front suspension: Independent Coil springs Wishbones	Unitized body and frame Three speed transmission	Rear suspension: Nonindependent Coil springs Solid U-shaped rear axle pivots in center
Front-wheel drive Swing axles Rack-and-pinion steering	Top speed: About 75 m.p.h. Gas mileage: About 30 m.p.g.	

SAAB



Saab uses the same engine design as the DKW. Built by a Swedish airplane company, it is sleek and agile. Having a front-wheel drive, it requires no longitudinal drive shaft. Its rear-axle design is most unconventional. For sure-footedness in deep snow and on ice, this car is hard to beat



Wheelbase: 78.8 inches

Rear engine, inline overhead-camshaft, two-cylinder, air-cooled, 20 horsepower

Front suspension: Independent Coil springs Wishbones	Unitized body and frame Four-speed transmission, all synchromesh	Rear suspension: Independent Coil springs Front and rear radius rods Rear-wheel drive through swing axles
Gas mileage: About 50 m.p.g.	Top speed: About 65 m.p.h.	

NSU



One of the world's best-known motorcycle companies, NSU now has a small car, the Prinz. Newest model is the sports coupe shown here. No price is available for this sleek beauty (the sedan price is listed above). Both are powered by a two-cylinder air-cooled engine mounted in the rear



Freshest design of the year is this Austin A40 sedan-wagon. Its roof extends all the way to the rear of the body. Back seat folds to make a huge luggage area, combining the advantages of sedan and station wagon



Wheelbase: 83.5 inches
 Front engine, inline OHV four-cylinder, water-cooled
 38.5 horsepower
 Front suspension: Unitized body and frame
 Independent coil springs
 Rear suspension: Nonindependent leaf springs
 Solid rear axle
 Rear-wheel drive by exposed drive shaft
 Four-speed transmission
 Gas mileage: About 32 m.p.g.
 Top speed: About 70 m.p.h.

AUSTIN

	Price*	Displacement	Curb Weight	Over-All Length	Over-All Width	Turn Circle	Front Headroom	Front Legroom
AUSTIN A40	\$1795	57.82	1620	144.3	59.4	35.0	36.0	37.5
SKODA 440	\$1686	66.43	1984	160.1	63.0	33.0	36.8	38.0**
VOLKSWAGEN	\$1545	72.74	1609	160.2	60.6	36.0	38.6	40.0**

* Port-of-entry price at New York City

** Approximate



Skoda has an unusual forked frame and uses transverse leaf springs both front and rear. Built in Czechoslovakia, it is one of the few vehicles now being imported into the United States from behind the Iron Curtain



Wheelbase: 94.5 inches
 Front engine, inline OHV four-cylinder, water-cooled,
 40 horsepower
 Front suspension: Forked tubular frame with transverse leaf spring
 Rear suspension: Independent transverse leaf spring
 Four-speed transmission
 Gas mileage: About 30 m.p.g.
 Top speed: About 70 m.p.h.
 Swing axles
 Rear-wheel drive through torque tube

SKODA



Completely unconventional, the Volkswagen continues the same chassis and over-all styling it has had since it began. There are no changes for 1959. Torsion bars suspend all four wheels (all independently) and the flat four-cylinder air-cooled rear engine is as dependable as always



Wheelbase: 94.5 inches
 Rear engine, flat OHV four-cylinder, air-cooled,
 36 horsepower
 Front suspension: Forked tubular frame with welded-on platform
 Rear suspension: Independent by trailing arms, solid transverse torsion bars
 Four-speed transmission
 Gas mileage: About 32 m.p.g.
 Top speed: About 68 m.p.h.
 Swing axles
 Rear-wheel drive

VOLKSWAGEN



Wheelbase: 105 inches
 Front engine, inline OHV four-cylinder,
 water-cooled, 66 horsepower

Front suspension: Independent
 One transverse leaf spring
 Rack-and-pinion steering
 Gas mileage: About 26 m.p.g.

Unitized body and frame
 Four-speed transmission, all synchromesh
 Top speed: About 80 m.p.h.

Rear suspension: Nonindependent
 Coil springs
 Solid rear axle
 Rear-wheel drive through torque tube

PEUGEOT



Substantial and not at all austere in looks, the French Peugeot is a full-size car (about as big as the Lark). But it's amazingly economical. And the price is very low, considering the extras that you get with it

	Price*	Displacement	Curb Weight	Over-All Length	Over-All Width	Turn Circle	Front Headroom	Front Legroom
PEUGEOT 403	\$2175	89.6	2352	176.0	66.0	30.0	36.0	40.0**
LLOYD TS	\$1395	36.4	1260**	132.1	55.8	34.5	33.8	39.8
CITROEN 2CV	\$1298	25.9	1120	148.8	58.3	32.5	36.0	42.0

* Part-of-entry price at New York City

** Approximate



Wheelbase: 78.8 inches

Front engine, inline OHV two-cylinder, air-cooled,
 25 horsepower

Front suspension: Independent
 Two transverse leaf springs (superimposed)
 Rack-and-pinion steering
 Gas mileage: About 42 m.p.g.
 Front-wheel drive

Tubular backbone with welded-on platform
 Four-speed transmission, all synchromesh
 Top speed: About 62 m.p.h.

Rear suspension: Independent trailing wishbones and coil springs
 No rear axle as driving wheels are in front

LLOYD



Lloyd has a new and larger engine that drives through the front wheels. Its rear suspension is unusual with the trailing wishbones and coil springs. Its tubular backbone is the main structural member of the car



Wheelbase: 94.4 inches
 Front engine, flat OHV two-cylinder,
 air-cooled, 12 horsepower

Front suspension: Independent on leading arms interacting with rear through central coil springs
 Front-wheel drive
 Gas mileage: About 46 m.p.g.

Ladder-type box-section frame
 Four-speed transmission, all synchromesh
 Centrifugal clutch
 Top speed: About 52 m.p.h.

Rear suspension: Independent on trailing arms sharing common coil springs with front wheels
 No rear axle as driving wheels are in front

CITROEN



If you tried to make a car uglier than the 2 CV, you couldn't. Nor could you make one more beloved by its owners. It will go anywhere, under any conditions. Suspension is as unique as its styling and is soft enough to cushion eggs, rugged enough to haul pianos—no wonder the French love it



Wheelbase: 102.5 inches

Front engine, inline OHV four-cylinder, water-cooled, 85 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Nonindependent
Coil springs	Three-speed transmission	Coil springs
Wishbones	(four-speed all-synchromesh optional)	Solid rear axle
Gas mileage: About 25 m.p.g.	Top speed: About 90 m.p.h.	Rear-wheel drive through torque arms
		Two-piece exposed drive shaft

Volvo is built by Swedes to last forever—or at least so it seems. It is a solid car, unadorned but peppy. And it travels a surprising distance on a gallon. It may look stodgy, but don't be fooled. It goes!

VOLVO

	Price*	Displacement	Curb Weight	Over-All Length	Over-All Width	Turn Circle	Front Headroom	Front Legroom
VOLVO PV 444	\$2239	96.5	2140	177.0	62.5	32.5	39.0	47.0
RENAULT Dauphine	\$1645	51.5	1397	155.0	60.0	30.0	37.5	42.0
OPEL REKORD	\$1958	90.8	1995	174.0	63.6	34.8	36.0	43.5

* Part-of-entry prices at New York City



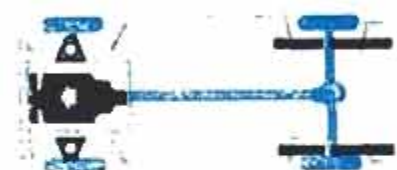
Wheelbase: 89.4 inches

Rear engine, inline OHV four-cylinder, water-cooled, 32 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Independent
Coil springs	Three-speed transmission	Coil springs
Wishbones for lower arms	(automatic clutch optional)	Swing axles
Rack-and-pinion steering	Top speed: About 70 m.p.h.	Rear-wheel drive
Gas mileage: About 36 m.p.g.		

Renault's little princess, the Dauphine, is currently the best selling four-door foreign car in the United States. And with reason. It has European styling, but is not so peculiar as to be embarrassing. Its rear engine, a water-cooled four-cylinder, purrs around town and is almost inaudible at idle. Typically French, it has wet cylinder liners

RENAULT



Wheelbase: 100 inches

Front engine, inline OHV four-cylinder, water-cooled, 56 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Nonindependent
Coil springs	Three-speed transmission	Leaf springs
Wishbones	all-synchromesh	Solid axle
Gas mileage: About 26 m.p.g.	Top speed: About 78 m.p.h.	Rear-wheel drive by exposed drive shaft

Certainly the most American looking of the imports is the Opel Rekord. Built by General Motors in Germany, it is sold by Buick over here. The chassis is conventional and except for its unit body, it could be a domestic GM car. Also available is a very handsome station-wagon model

OPEL



Wheelbase: 84.0 inches

Front engine, inline OHV four-cylinder, water-cooled, 40 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Nonindependent
Coil springs	Four-speed transmission	Leaf springs
Wishbones	automatic clutch optional	Solid rear axle
Gas mileage: About 35 m.p.g.	Top speed: About 65 m.p.h.	Rear-wheel drive by exposed drive shaft

TRIUMPH



If you want a truly compact car, this is it. Inside its 145-inch overall length are four doors, a front engine and a rear trunk. Narrow doors make exit and entry tricky, but once inside there's amazing room

	Price*	Displacement	Curb Weight	Over-All Length	Over-All Width	Turn Circle	Front Headroom	Front Legroom
TRIUMPH	\$1699	57.8	1680	145.0	58.0	32.0	38.0	45.5
VAUXHALL Victor	\$1958	91.9	2180	166.2	62.5	34.0	35.5	43.0
SIMCA Aronde	\$1645	77.5	2100	162.0	61.3	31.0	35.4	37.0

* Port-of-entry price of New York City



Wheelbase: 98.0 inches

Front engine, inline OHV four-cylinder, water-cooled, 54.8 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Nonindependent
Coil springs	Three-speed transmission, all synchromesh	Leaf springs
Wishbones	Top speed: About 74 m.p.h.	Solid rear axle
Gas mileage: About 30 m.p.g.		Rear-wheel drive by exposed drive shaft

VAUXHALL



First of the British cars with a wrapped windshield, the Vauxhall, like Opel, is a "naturalized" American citizen. It is built in England by GM and, some British claim, is more American than English. Whatever its origin, it is a trim, sensible design. Suspension is conventional and the shift lever is on the steering post where Americans expect it to be



Wheelbase: 96.3 inches

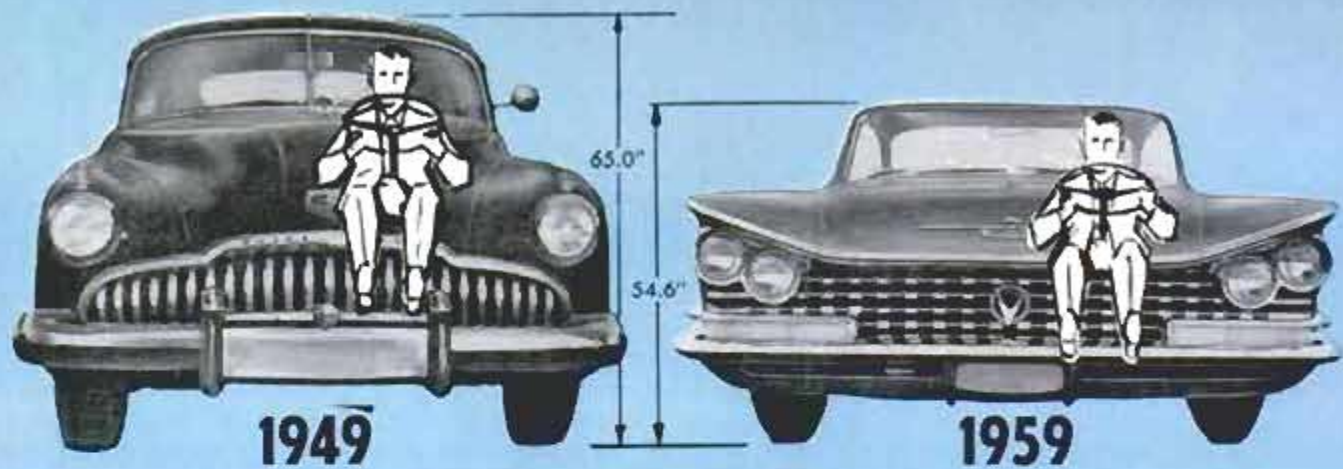
Front engine, inline OHV four-cylinder, water-cooled, 48 horsepower

Front suspension: Independent	Unitized body and frame	Rear suspension: Nonindependent
Coil springs	Four-speed transmission	Leaf springs
Wishbones	automatic clutch optional	Solid rear axle
Gas mileage: About 30 m.p.g.	Top speed: About 80 m.p.h.	Rear-wheel drive by exposed drive shaft

SIMCA



Chrysler now sells Simca in this country. It is a conventional design, well thought of in France. A new model of the Aronde was introduced recently (not shown here) which has a lower, more modern look. The car in this photo, however, is the one now being sold over here



Drivers don't change, but look what has happened to the automobile in just 10 years—10 inches lower!

WHERE DID THE INCHES COME FROM?

By Roger Huntington, SAE

THIRTY YEARS AGO, a prominent Packard engineer, surveying the company's new low-slung hypoid rear axle, confidently predicted that American passenger sedans might some day be as low as 66 inches.

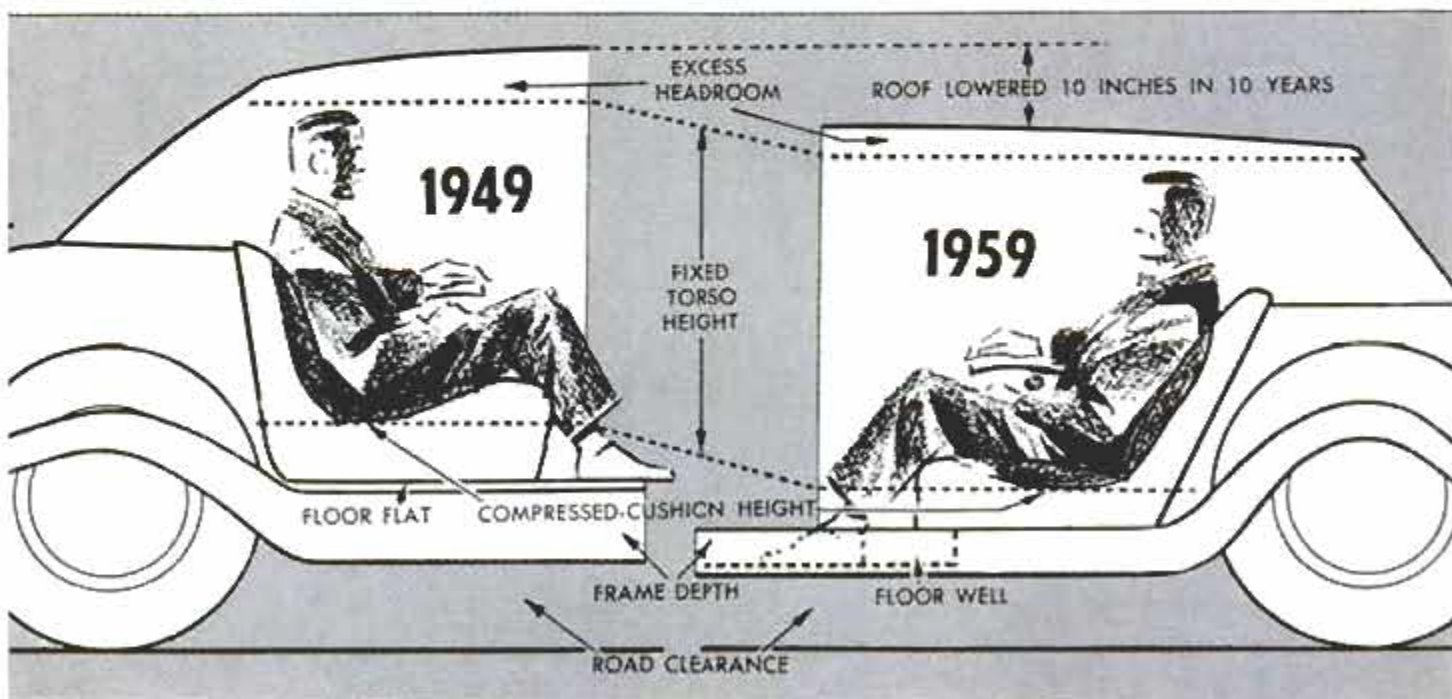
The 1959 model crop out of Detroit runs in height from 54 to 59 inches. Some models

are as much as two inches lower than corresponding 1958 bodies.

Yet the crystal-ball gazers tell us we're heading even lower—down to 52 inches. They say sales indicate that the low look is what John Q. wants and Detroit is going to give it to him.

Where did the inches come from? How

Here are the body's vital statistics. After 10 years, the problem is the same, but the solution is different



did we get so much lower than the best engineers were predicting 30 years ago? How can we possibly get any lower?

Good questions, all of them. To get the answer you must analyze what determines car height. Several vital dimensions add up to set the over-all height of a body. Starting at the pavement, we move up through the "ground clearance" area, the distance between the ground line and the lowest part of the car's undercarriage.

There has to be space here to clear obstructions on back-country roads and to provide ramp clearance at the center of the chassis for leaving steep driveways. Current models have minimum ground-clearance figures ranging from a little over five inches to about seven inches. Engineers don't see how they dare reduce this even as much as a half inch on future models.

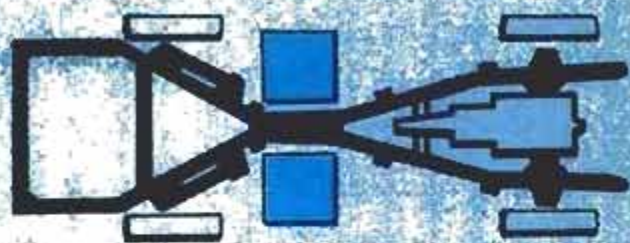
The vertical distance between the ground-clearance line and the floor of the passenger compartment is "open to negotiation," so to speak. It will depend on the layout of the chassis. If the car uses a frame, the floor can be dropped below the top of the frame side rails by putting footwells in the floor pan. This is the by-now-familiar step-down construction, used by all except Chrysler Corporation. It requires a special frame design to make room between the rails for wells while maintaining adequate stiffness.

Things are simplified with the unit body construction in which there is no separate chassis frame and the body is welded up as a sturdy box structure. In this design, you can place the floor anywhere you want. Of course, there still must be room under the floor for the exhaust pipes and mufflers. Running the exhaust along the frame rails (as on the Continental Mark II) is expensive. Finding room for the exhaust system is one of Detroit's biggest headaches today and you'll see radical changes by 1961.

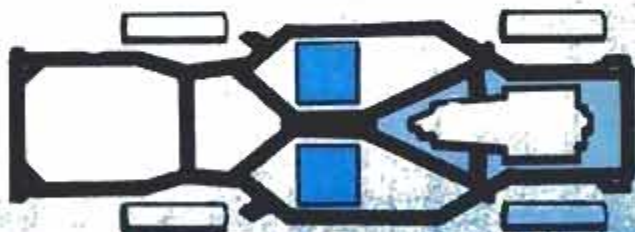
The next dimension is seat height. Seats have been getting lower and lower for 10 years. The passenger is sitting more and more with his feet straight out in front of him. There's nothing particularly wrong with this, but it requires very careful seat design to get acceptable comfort in this position. Thigh and kidney support is vital. Some seats in low foreign sports cars do the job very well. Detroit is definitely behind in this problem. It looks now as though a minimum practical distance between the floor line and the lowest point of the compressed seat cushion (with an average-weight person in the seat) might be four inches. Many 1959 models are close to that right now.

Frame shape determines size of the floor wells for rear-seat riders. These drawings explain the reason

FRAMES DESIGNED TO PERMIT FLOOR WELLS



CADILLAC CHEVROLET PONTIAC

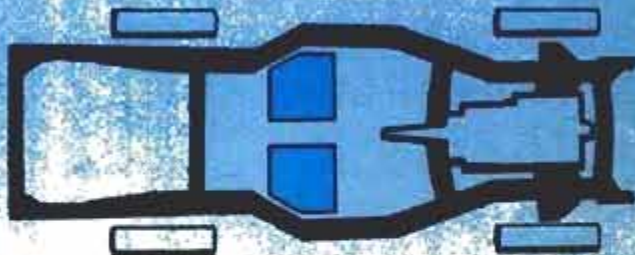


OLDSMOBILE

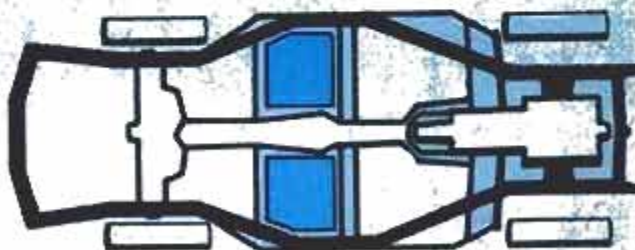


BUICK

STEP-DOWN FOOTWELL

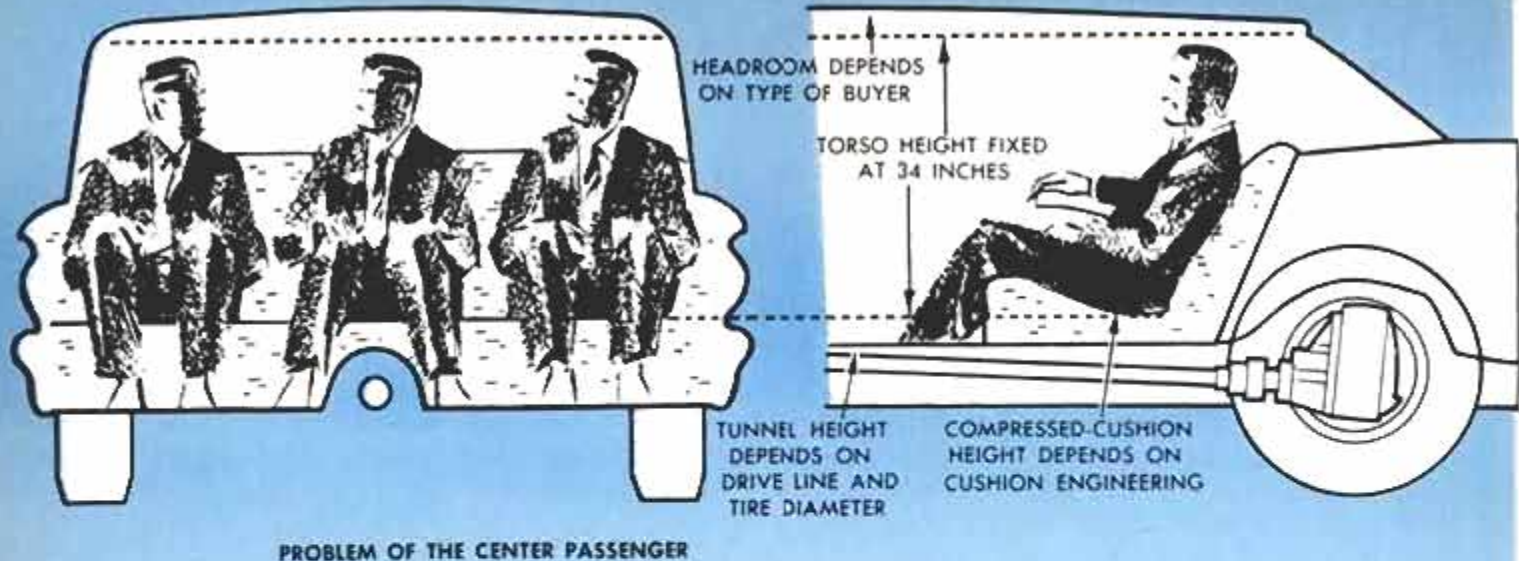


FORD MERCURY



UNITIZED BODY

LINCOLN, THUNDERBIRD, RAMBLER, AMBASSADOR



PROBLEM OF THE CENTER PASSENGER

Major problem is the center passenger. Unless we get major chassis changes, he will limit the lowering trend

Next is one of the fixed dimensions in body design—the height of the human torso in a seated position. In a reasonably upright position, the average height is 34 inches from seat to the top of the head. There is little we can do to reduce this dimension on future cars. Of course, we could tilt the passenger back a little, putting him in a semireclining position. There is just a hint of this on some 1959 models. How much of this the public will put up with for style, only time will tell.

Above the head we must allow a little excess room for the taller riders and, in some cases, for hats. This dimension is not so fixed as some others. For instance, you would allow more headroom in a Cadillac limousine than in a sporty Plymouth Fury. The man who buys the Fury will put up with less headroom (perhaps even would be willing to take his hat off) to get the flashy body lines.

Probably an average allowance on all cars for excess headroom should be four inches between head and ceiling.

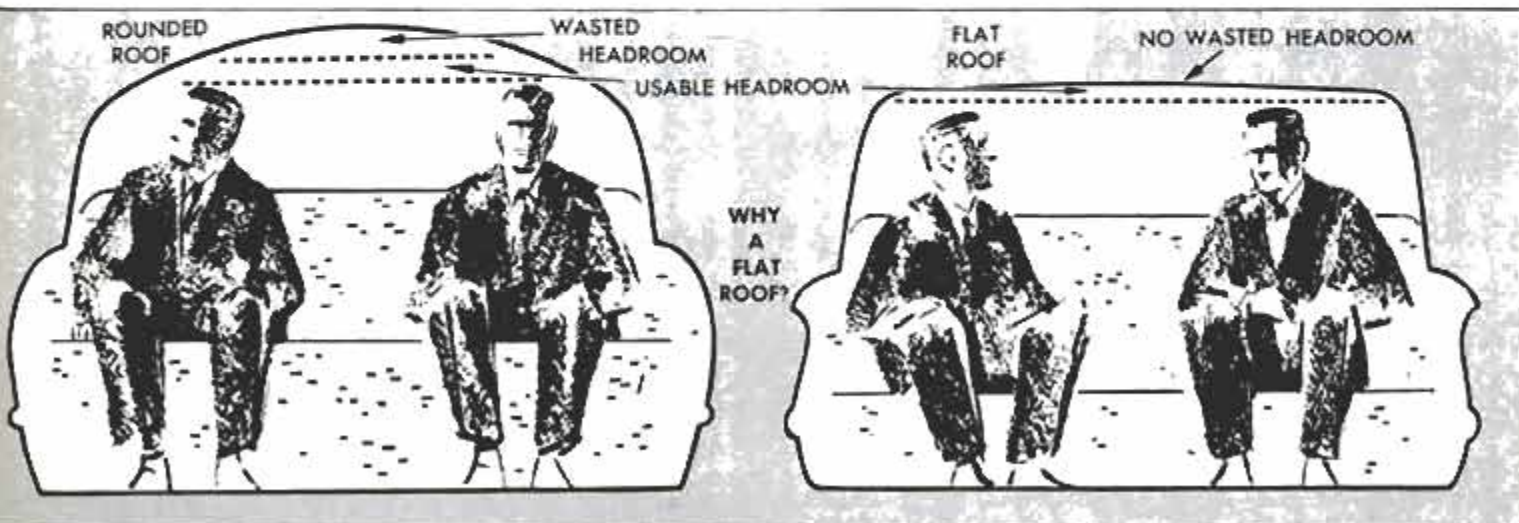
The thickness of the roof structure (upholstery and metal) doesn't need to be much over a half inch. If the roof panel is curved, obviously we're going to have waste headroom in the center. We must allow a certain minimum headroom at the sides and clearance at the center where the roof bulge is more than needed. This makes the body one or two inches higher than necessary.

Flat roofs are the answer, of course. And the 1959 flattops will be common to the industry in the future.

Add up all these individual heights and what do you get? It looks as though the practical minimum over-all car height, using all the tricks, might fall somewhere between 48 and 53 inches. But only if we don't plan to seat more than four persons in the car.

We could reduce height to 52 inches tomorrow if it weren't for that center passenger in the back seat of our so-called six-passenger sedans. Between him and the drive-shaft tunnel is about 90 percent of

Flat roofs are practical as well as stylish. They eliminate the wasted headroom in the center of the seat



Detroit's problem. There just isn't any room left there to play with.

Three significant dimensions are involved: First, there is the height of the top of the drive-shaft tunnel above the road. This is largely determined by tire radius and the design of the differential and drive shaft. The 14-inch wheels have helped some (although the latest low-profile 15-inch tires are just as low).

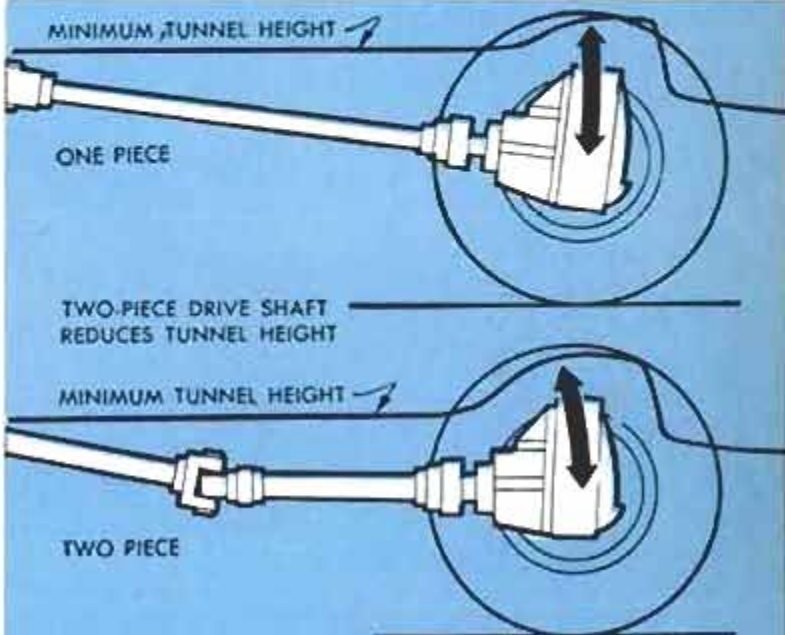
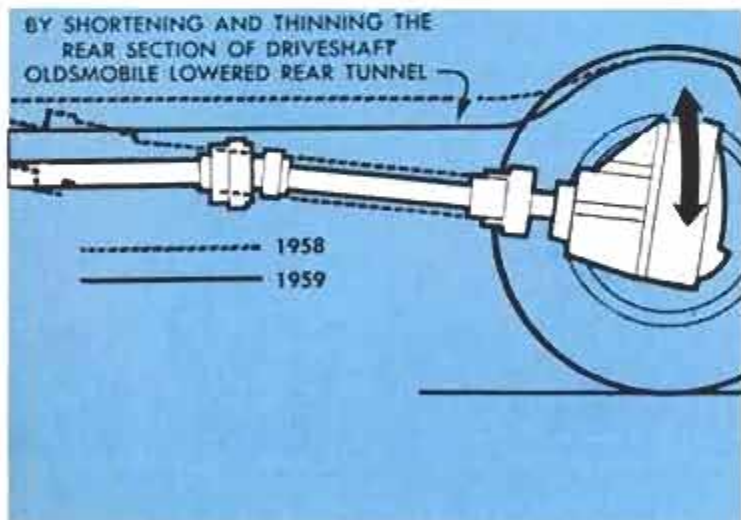
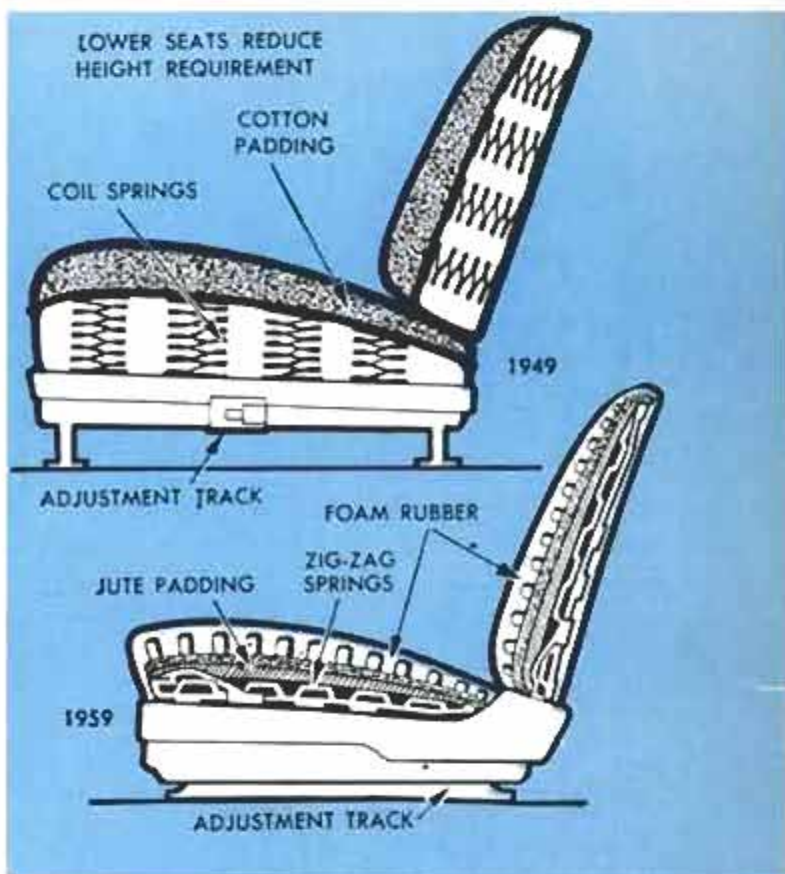
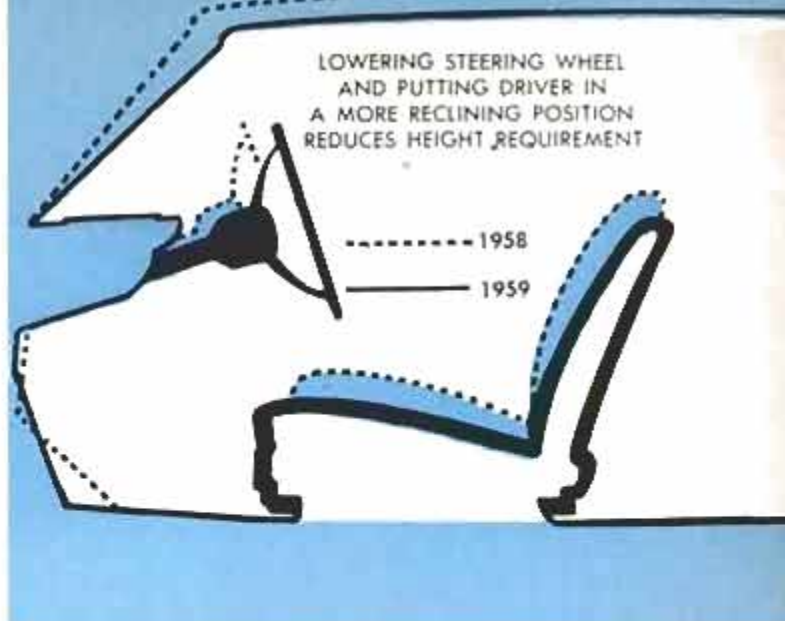
Ford reduced the drive-shaft height at the rear axle by designing the hypoid rear-end gears to lower the pinion gear $\frac{3}{4}$ inch on the ring gear (which, incidentally, was a very ticklish engineering and production problem). The GM divisions have gone to two-section drive shafts so there won't be so much up-and-down swing as wheels go over bumps. Oldsmobile even shortened its rear shaft section for 1959, to reduce further the amount of upswing. Ford and Chrysler have necked down the outside diameter of their one-piece drive shafts at the rear. On its bulky torque-tube drive, Buick designed a clever two-section tube with a kink near the rear axle under the seat.

The second dimension is the seat-cushion thickness above the tunnel. This is a killer. Every inch of cushion that the occasional center-passenger gets (and how often do you ride three in back?) is one inch added to the car's over-all height.

Detroit is trying to compromise here. On some cars compressed-cushion thickness over the tunnel is less than one inch and the passenger "bottoms" on many bumps on reasonably smooth roads. A heavy passenger may contact the tunnel all the time (which might be less annoying and uncomfortable than bumping up and down on it). On the other hand, some companies, by clever design all through the chassis and body, manage to get compressed-cushion thickness of two to four inches over the tunnel and still retain low body lines.

The third dimension is the passenger.

(Continued to page 278)





In this exclusive *PM* interview, Ford Motor Company's top stylists talk frankly about automobile styling

WHY DO OUR CARS

Here's what stylists say at Ford:

QUESTION: Many writers are saying that you stylists are doing the best you can to destroy the automobile industry by your designs. It seems that this is a good time to ask you "What does a stylist do? How does he think?"

WALKER: Let me start off by saying that there are people who are asking "Why are cars so long? They won't go in my garage." This is not always true. The average garage is 20 feet long and there isn't a car that is 20 feet long. If they would take the baby buggy and the wheelbarrow out of the garage they could get the car in. Of course, we don't want to dictate to the public how to run their garages.

QUESTION: How do you define an automobile? What is this thing you design?

MAGUIRE: It is many things to many people. Today's Thunderbird is two or

three cars. It could be a tailored, refined car for the man who wants it to be that. It could be a spooky, sporty little car to the man who wants that. A car isn't like a radio or a refrigerator or a house. It has to have more character.

WALKER: When you think of an automobile, you think of movement and that means aerodynamics.

ENGEL: You can easily define a refrigerator. It's a box to hold food that must be neat and clean. But a car is more than just a bus or taxi.

WALKER: It's the most expensive expendable product a family buys so there is pride of ownership involved.

QUESTION: You say cars are many things to many people. Does this complicate your design problems?

(Continued to page 178)

Interviewed by Arthur R. Railton, PM's Automotive Editor, were George W. Walker, Vice-President and Director of Styling; Elwood P. Engel, staff stylist, and Robert H. Maguire, chief interior stylist, all of the Ford Motor Company.



George W. Walker, Ford Vice-President and Director of Styling:

"How many times a day does a person get in and out of a car? We say . . . about four times a day. Why would he forsake good silhouette just because he knocks his hat off a few times a day. If we were designing a milk wagon we would make it high enough so a man could jump in and out without knocking his hat off."



Chrysler stylist Exner, center, set the pattern for the industry with the Dart look of his 1957 products

Here's what stylists say at Chrysler:

QUESTION: Why is there so much criticism of auto styling today?

EXNER: Everyone is looking for some place to lay the blame for the poor business conditions of the past year. If cars had sold the way they did in 1955 you wouldn't have heard any of this.

QUESTION: How do you define an automobile? How do you think of it while designing one?

EXNER: First, it's a means of transportation, but it must be as exciting as possible. It should create a desire for ownership and a pride of ownership. A person is looking for something with a feeling of motion that inspires him with its grace and excitement.

SCHMIDT: If we can bring out a new car that is a fine means of transportation, but makes you enthusiastic about going in-

to the showroom to buy it, then we've done an excellent job.

QUESTION: Then the stylist must create demand?

SCHMIDT: I'd say so. We are really merchandisers.

EXNER: Your product must look more exciting than the other fellow's. First of all, though, it must look like an automobile. That's why we have this Dart theme, this look of motion.

QUESTION: You must be flattered to be imitated in this concept by General Motors.

EXNER: Yes, we are somewhat flattered.

QUESTION: What is a good automobile design?

EXNER: I think we've already answered that. Excitement is the word for it. It must excite your desire to own it.

(Continued to page 179)

Taking part in the PM interview were Virgil M. Exner, Chrysler Vice-President and Director of Styling, and William M. Schmidt, Executive Stylist. Arthur R. Railton, PM's Automotive Editor, asked the questions.

Virgil M. Exner, Chrysler Vice-President and Director of Styling:

"We could put excitement in a smaller package. But the public has indicated its preference for larger packages. . . . Stylists don't want a lot of chrome, either. But people have demanded it through the years. Every attempt I know of that has ever been made to strip a car, to take off its chrome, has met with failure."



MAGUIRE: Right. You buy a car more because you want it than because you need it. The old car probably didn't wear out. You have a desire to acquire a new car. You don't have this feeling about a refrigerator. You get excited about a car. You don't get excited about any other product to the same extent.

WALKER: You should have been with us all afternoon. We've been looking at the '61 models and trying to answer these questions for ourselves.

MAGUIRE: It's a frightening thing to look at future models. Over here, there will be a new concept of a car. Across the room, there will be another concept. Both are aimed at the same objective. Both will carry passengers. Which do you pick? Which fits the character we have created for our automobiles? The design must fit that character. If we were designing a radio or a desk, there would be more "form follows function" and we wouldn't have that problem. But a car is more than a machine. It has to be a lot more than just a machine.

ENGEL: And it has to be right because it involves millions and millions of dollars.

MAGUIRE: Don't get me wrong. It also has to be a good machine. It has to be clean and nice, but it has to be more than just clean and nice. Many industrial designers don't understand that.

ENGEL: Industrial design has a little of the architectural quality about it, a little stiffness that you can't have in a car.

QUESTION: How should an automobile look?

MAGUIRE: It is easy to say how it should not look. It is something else to be constructive. It's easy to say cars are too big, too low or have too many fins. But take all the fins off and you end up with a piece of soap with wheels on it. Those fins finish off the metal, they give the full length to the car. The question is how much fin?

QUESTION: In other products, the simple designs seem to be taking over. Like furniture, for example. Is this true of automobiles, too?

ENGEL: Yes, there has been a change since 1955 or so when people wanted lots of chrome and two and three-toning. They want it played down a little now, want it a little quieter.

MAGUIRE: We have just looked at four brand-new concepts of cars for future use here. That's a hard job—to willfully get off, to drop, something that's doing well. You have to decide whether to stay with a good thing and just evolve or to cut off and start something real new. Today's Buick, for example, is utterly different from last year's. They must have decided to wipe the slate and start over. Fine. That takes nerve.

WALKER: We did a big thing with the Thunderbird. The public is saying it doesn't want luxurious, expensive cars. So we come along with the Thunderbird. It's not a cheap car, it sells for nearly \$5000 and we can't make them fast enough to keep up with orders.

QUESTION: But doesn't the success of the Thunderbird, which is small, indicate that there may be some justification for the criticism that cars are too big?

MAGUIRE: No. I don't think so. I think it just happens to be small, but the reason people buy it is because it's lush.

QUESTION: Then you don't think its appeal has anything to do with its size?



WALKER: "The American public is moving upward all the time. When the workingman gets a little more money, he wants a bigger car. You can't change that."



ENGEL: "I would say cars are not going to get much longer. But I'd never say they weren't going to get any lower. I don't know how low they'll go."



MAGUIRE: "It's easy to say cars are too big, too low, or have too many fins. But take all the fins off and you end up with a piece of soap with wheels on it."

Continued to page 282)

QUESTION: But aren't there people who don't like to be excited into buying something?

EXNER: There are, I suppose, people who might be content with just transportation, without this excitement. But I think if they were put to the test, they would feel just a bit cheated if you gave them just transportation.

SCHMIDT: They can go out and buy many automobiles that have nothing but transportation right now. Automobiles with no excitement, no flair, no modern feeling, but with just a way to get from one place to another. But sales don't indicate that there is a majority in this group.

QUESTION: Do we need bigness to get this excitement you talk about?

EXNER: It could be done in a smaller package. But the public has indicated its preference for larger packages through the years, through sales experience. Stylists don't want a lot of chrome either. But people have demanded it through the years. Every attempt I know of that has ever been made to strip a car, to take off its chrome, has met with failure.

QUESTION: Are you concerned with more than looks, with the practical nature of the car?

EXNER: Contrary to what a lot of people think, we work very closely with engineering and manufacturing groups. Many things we might want to do strictly for looks are not practical and have to be turned down.

QUESTION: It seems to me that there have been great changes in styling in recent years, but few in engineering. Are engineers failing to keep up?

EXNER: They are always working on changes, but many are too costly. That is one reason why they haven't appeared. But I would say that engineers have kept up. In fact, we couldn't have done many things we've done in styling if they hadn't.

SCHMIDT: No matter what car he buys today, the customer assumes it will be dependable. So the next question is, which car does he want to be seen driving? And then you're talking about the appearance factor. We make you want to buy our car because you'd rather be seen in it than in somebody else's.

QUESTION: Who initiated the demand for a lower car? Stylists or engineers?

EXNER: The stylists. It is to get better proportions. But in most cases engineering agrees with us because it gives the car more stability and that reflects well on them. The styling reflects well on us, so we both stand to gain from it.

QUESTION: Aren't there undesirable complications that go along with lowness?

EXNER: That's true. But we feel that the plusses outweigh the minuses. It took a lot of engineering, a lot of head scratching and hard work by a lot of people to get cars down as low as we have while retaining the same major chassis components. There's plenty of engineering in that low package. Perhaps it isn't as sensational as the styling changes, but it's still a lot of achievement.

QUESTION: Are we ever going to have comfortable six-passenger cars as long as we have low cars with high center tunnels?

EXNER: I believe so. Continuous effort is being made, although it may seem slow to the public. Seats are being made more comfortable. We need some major changes

(Continued to page 288)



SCHMIDT: "If we can bring out a new car that is a fine means of transportation, but makes you enthusiastic about going into a showroom to buy it, then we've done an excellent job."



EXNER: "We call it horse-trading. If we can save \$5 on a rear bumper we might take that money and put it into a more expensive grille. We don't have to spend a certain amount on each part, but the total cost must not exceed a certain amount."



SCHMIDT: "They can go out and buy many automobiles that have nothing but transportation right now. Automobiles with no excitement, no flair, no modern feeling . . . But sales don't indicate that there is a majority in this group."



Two industrial designers offer an imaginative design for the most useful vehicle of all . . .

THE SUBURBAN RUNABOUT

IT HAS NO TAILFINS. It has almost no overhang (what little there is can be unbolted and replaced if damaged). It doesn't look like anything you've ever seen.

At the front it has the sleekness of a fast sports car. At the rear, the roominess of a Greyhound bus.

It is an imaginative shopper-commuter vehicle sketched by two industrial designers as a possible solution to the transportation mess in urban and suburban America.

Jay Doblin, Director of the Institute of Design, Illinois Institute of Technology and former president of the American Society of Industrial Designers, and W. W. Fitzgerald, head of the Product Design Department at the same school, put this practical "dream car" on paper.

Popular Mechanics asked these men, typical of the industrial designers who criticize Detroit styling, to suggest a ve-

hicle which, in their judgment, would be a practical, serviceable machine for housewife, commuter or small-city dweller—a new form of transportation appliance.

They were asked to design a car that might become the "first" car among America's fast-increasing two-car families—a car that would be used most of the time while the bigger, more powerful family car was saved for long trips and vacations.

Designed for urban use exclusively, the car they suggest would seat two adults in comfort, with ample headroom and legroom. There is space for three children in the rear-facing back seat.

It is very small. Wheelbase is only 80 inches, over-all length only 140.5 inches (making it almost six feet shorter than a Ford, Chevy or Plymouth). But it will do almost everything the average suburbanite requires of a car and do it, the designers say, cheaper and more efficiently than the big car.

The rear-facing back seat folds down to form an easy-to-load package shelf for hauling groceries or even such bulky items as chairs and tables for the PTA or the bridge club. Front seats fold individually so the handyman owner can haul long boards home from the lumberyard for his week-end projects.

Doors slide back (they don't swing) and the car parks in tight spaces without entrapping its occupants. Stoplights and turn indicators are mounted





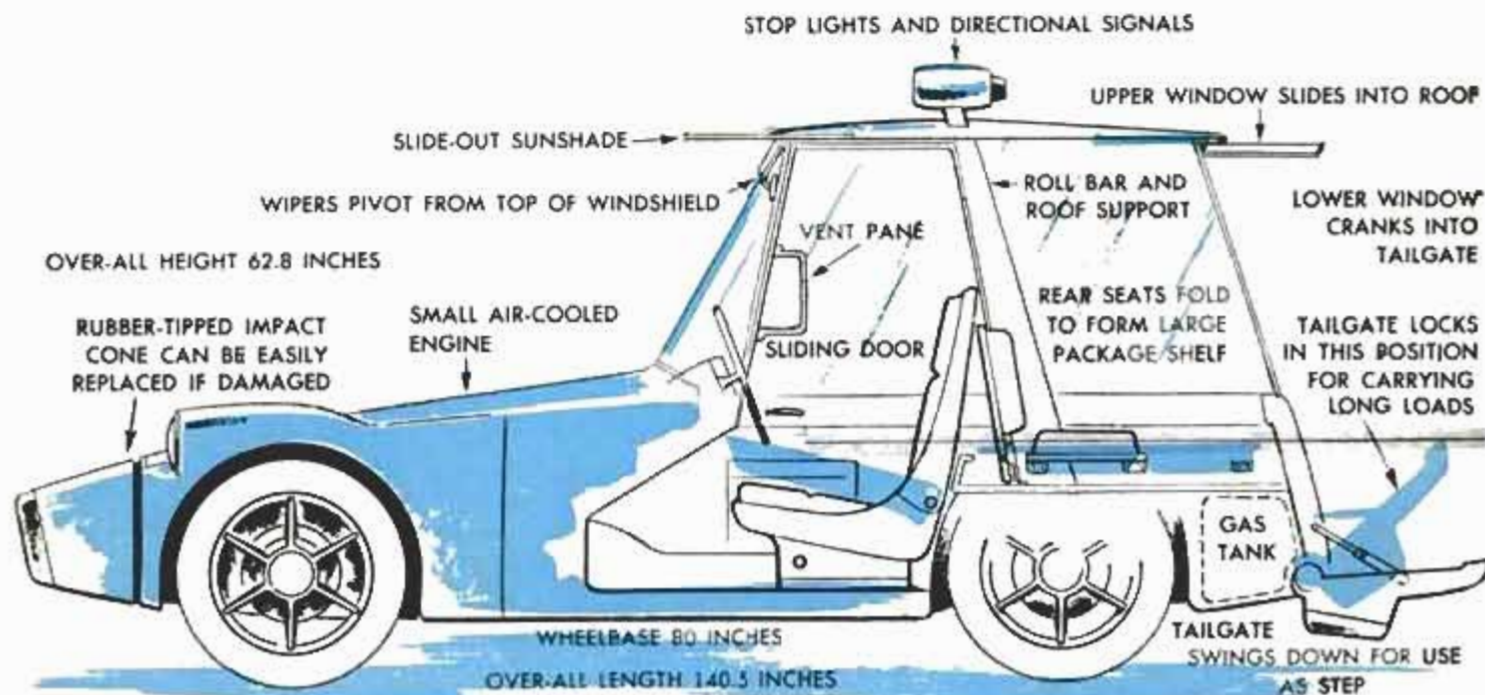
high on the roof so big-car drivers can't fail to see the smaller vehicle. In traffic, the lights can be seen several cars back.

Rubber-tipped impact nose and tailpiece absorb minor bumps in parking jostling. More serious collisions would crumple the impact pieces, providing absorption of forces and reducing the chance of injury to occupants. Damaged pieces are unfastened and replaced (as are all body panels) by removing easily accessible bolts hidden under pop-out plugs.

There's plenty of visibility for relaxed handling in traffic and for effortless parking. An integral roll bar wraps entirely around the passenger compartment and also supports the roof, permitting the use of the narrowest window posts. Brakes are big, open and well cooled.

A small air-cooled engine is proposed, probably a flat four. The designers suggest a two-speed automatic transmission.

Obviously, this car is not going to replace the great American automobile, but it does indicate what could result if tradition is ignored and designers take a fresh look at the old problem of sitting down while going from one place to another. ★ ★ ★





By Dale Kelly, SAE

TO SOME OF US, a new car is to drive, to enjoy and, less pleasantly, to pay for. But to others, it's a challenge to invest in gadgets that claim to banish wear, eliminate friction, reduce gas consumption and boost performance.

Unfortunately, many "miraculous" gadgets are not all they are claimed to be. Some are out-and-out frauds. A few do have real value, others may even damage your car.

The most flagrantly worthless devices are usually the ones with the longest list of testimonials from satisfied owners. No real test data is given, only generalities. No real explanation is given of how the device works.

Testimonials are not necessarily proof of a product's value. If an utterly useless device is tried out by enough motorists, some will imagine that their cars run better and a few will even claim, as a result of slipshod tests, amazing increases in performance and economy.

If a device actually does have measurable value, the manufacturer will probably substantiate it by a test report from an independent test laboratory. Many laboratories are available that will run such tests at a

cost equal to a tiny fraction of the profits frequently made by a successful car gadget.

Anybody who makes a device that operates on a new principle will usually patent it to protect his rights. If a product is not patented, it is probably not a new principle. If the advertisement does give a patent number you can get a copy of the patent and find out exactly what is new about it simply by sending 25 cents to the Patent Office in Washington, D. C.

Promises of "satisfaction or your money back" are not always proof of merit. Promoters know that only a small fraction of dissatisfied buyers will bother to remove, wrap and mail back a device that costs only a few dollars.

In the following pages we list several types of products, ranging from the worthless to the acceptable. Our judgments are based on available scientific and engineering knowledge.

Of course, the gasoline engine, the self-starter and even the automobile were at one time considered impractical by experts. So there is always a chance that some genius will come up with one of the following that really works. But it is unlikely.

These Probably Won't Do What You Expect Them to

Ignition intensifiers, complex spark plugs or coils that claim to give more sparks or "hotter" sparks.

A normal ignition system in good condition consistently delivers a spark hot enough to initiate the flame wave, which in turn ignites the bulk of the fuel-air mixture.

If the ignition system is not in good condition, it may occasionally miss. But there is no such thing as a "partial" miss, nor can you get better combustion from a hotter-than-normal spark.

No matter how many electrodes a spark plug has, the spark will, at any given moment, occur only at the one that requires the least voltage.

Furthermore, some special coils draw excessive current which may rapidly burn distributor points. Some special spark plugs, because of their complex gap configurations, are difficult or impossible to clean and have gaps that cannot be adjusted for wear or to suit the requirements of a specific engine.

So-called igniters or other devices intended to be used in place of spark plugs probably are nothing more than spark plugs with a fancy name. They usually have the disadvantages of the complex configuration mentioned above.

Idle adjustments with additional air bleed.

These affect the proportions of air and gasoline at idle, but not at normal driving speeds. Standard carburetor adjustments permit complete control of idling mixtures and any result that can be obtained by the special adjustment screws can be obtained by adjusting the original carburetor.

Rebuilding engines by pills, pastes or liquids.

Tests in which gas-tank pills were weighed before and after use have shown no significant loss in weight of pills. Even if metal could be gotten into the cylinder (as by direct injection of liquids or pastes) it is hard to see how any metal could be expected to stick to the oil-covered cylinder walls. Not included in this classification are those cleansing agents and solvents which are designed to dissolve and remove deposits from carburetors and other parts of the engine. These solvents do have value for cleaning and freeing vital parts. They do not "rebuild" parts nor does any legitimate brand claim to.

Gas-tank additives or pills that reduce carbon formation in engine.

It is true that gasoline is 85 percent carbon, but the carbon is not "free." It is combined with hydrogen in various hydrocarbon molecules. Consequently nothing that can be done to it in the gasoline tank can, by any process now known, affect the way it burns in the engine.

Additives to make batteries last longer.

The National Bureau of Standards has tested scores of these and hasn't found a good one yet. A few years ago a promoter whose battery additive had been tested and found wanting by the Bureau persuaded a committee of the Congress that this was persecution of a struggling inventor by

ignorant bureaucrats, but a committee appointed by the National Academy of Science (the nation's highest scientific authority) found, after thorough investigation, that the Bureau's findings were correct.

Nonacid electrolyte for batteries.

These liquids are intended to be put into conventional storage batteries after the original dilute acid has been poured out. Plain water works about as well. Enough of the original acid adheres to the plates and the interior of the case to operate the battery, but at greatly reduced power and ampere-hour capacity.

Storage batteries guaranteed for unreasonable lengths of time.

The very best lead-acid batteries, at present, can't be counted on for longer than five years of automobile service. Guarantees of batteries that last forever are often limited (in fine print) to the time the battery is kept in the original car for which purchased and in the possession of the original buyer.

Waterless batteries which are claimed not to need periodic addition of water.

Any battery will operate for a while without additional water and these so-called waterless batteries usually last longer if water is occasionally added.

Generator-charge controllers for boosting generator output.

These are intended to increase charging rate for a short period each time the engine is started, then, by a time-delay circuit, cut out after a short overcharge. The standard regulator that comes with the car allows the generator to charge at the maximum rate it can deliver without overheating. Any higher rate involves risk of damage. If you want to take a chance on forcing a 30-ampere generator to deliver 35 or 40 amperes you can easily have it adjusted for that current. At least you know how much you are overloading the generator which is more than you can say when the "miracle" gadget is installed.

Theoretically, These Could Be Helpful. They Are Based On Reasonably Sound Principles, But . . .

Sintered-bronze oil filters.

It would seem that if properly serviced at frequent intervals these should be effective, but there is no test information to show that they would be more effective than the normally used disposable variety.

Magnetic crankcase drain plugs.

These have a magnet to remove iron and steel chips from the oil and, usually, have a small piece of magnesium to control acidity. A few iron and steel particles are found in most crankcases, but they seldom do any

harm. Acids do attack magnesium more readily than iron, steel or copper and every molecule of acid that reacts with the magnesium is, of course, one less to corrode vital engine parts. However, in the type of driving that keeps oil fairly warm, moisture does not collect, hence acid is not a serious problem. But a magnesium "sacrificial anode" could, if large enough, be useful in winter stop-and-go driving.

Radiator "neutralizers."

These serve the same function as the magnesium in the crankcase, but are not likely to do anything that won't be done as well, or better, by a liquid corrosion inhibitor which you should use regularly in your cooling system. If you live where antifreeze is necessary you won't need a neutralizer because most of the good antifreezes contain corrosion inhibitors.

Carburetor gadgets to admit extra air.

In some cars (those designed for economy of operation, rather than hot performance), carburetors are built to deliver the most economical proportions of air and gasoline. Admitting extra air, as the "miracle" gadgets do, can do no good and often can do considerable harm by oxidizing (burning) such hot parts as exhaust valves. In other cars, because the intake manifold does not distribute the mixture evenly to all cylinders, smooth operation and good power are obtained only by a mixture that is a little richer in gasoline than would be most economical.

In such engines, extra air in the right amount can improve economy a few percent, but too much air will burn the valves in the cylinders that inevitably get less than their correct proportion of gasoline because of the manifold shape.

In any case, the best way to obtain a mixture leaner in gasoline than afforded by the manufacturer's standard carburetor specifications, is to use the lean metering rods or jets with which most carburetor servicemen are familiar.

Some of these carburetor attachments also incorporate pinwheels below each carburetor throat. These add little or nothing to the performance of the device.

Extra air could substantially improve economy if (perhaps because of a partly closed choke) the mixture was much too rich to start with, but it would be simpler and cheaper to fix the carburetor than to buy and install a "miracle" gadget.

Fuel-pressure regulators, filters, neutralizers.

There are two general types: One reduces fuel-pump pressure (normally three to eight pounds) to about two or three pounds; the other type merely smooths out or damps the pressure pulsations. Most of them also have magnets to trap iron or steel particles, filters to remove other foreign particles, and active metals (such as magnesium) to control acidity.

Every fuel pump is designed to deliver a certain pressure and the carburetor that goes with it in the car is designed to handle the amount of pressure the fuel pump delivers. A pressure regulator, of course, can be helpful when a defective fuel pump delivers too much pressure or when the carburetor is not working correctly and cannot control the gasoline flow. But in either case, the more logical remedy, it would seem, would be to repair the fuel pump or the carburetor.

Most cars already have fuel filters and also have fuel-pump air chambers to damp out pulsations. If Detroit wanted lower pressures at the carburetor, a lighter spring in the fuel pump would provide them without need for additional plumbing.

If the regulator substantially reduces pressure at the carburetor, it could, at high speeds and under heavy loads, starve the carburetor and produce the injurious lean mixture described previously.

As for the magnets, filters and active metals, the first two duplicate in function the filters that come on most cars and we know of no evidence that the active metal is necessary or effective.

These Will Work But May Be More Trouble And Expense Than They Are Worth . . .

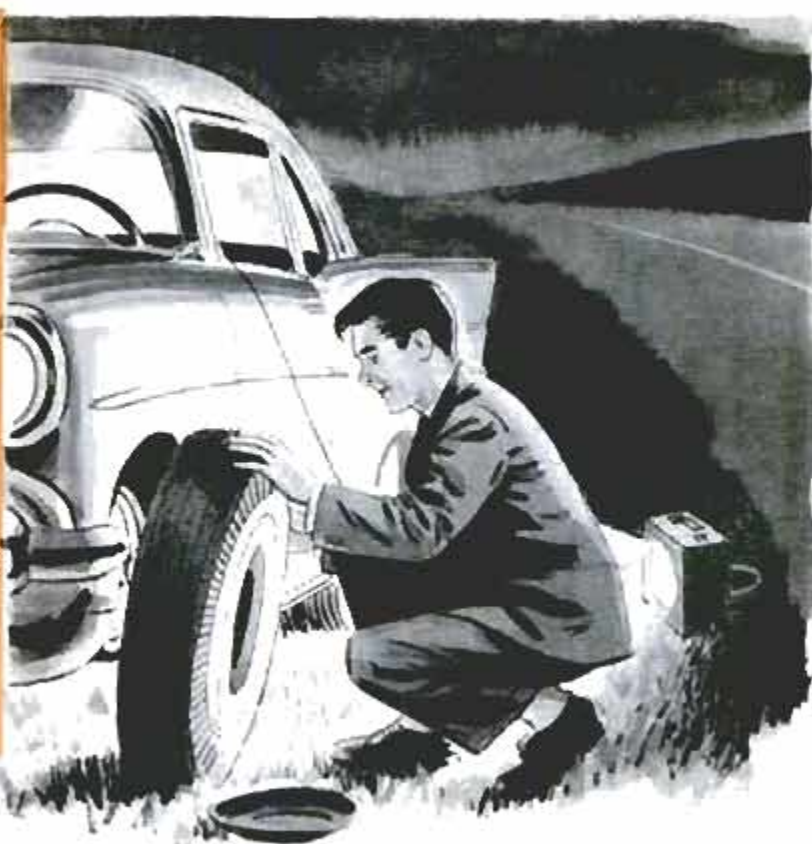
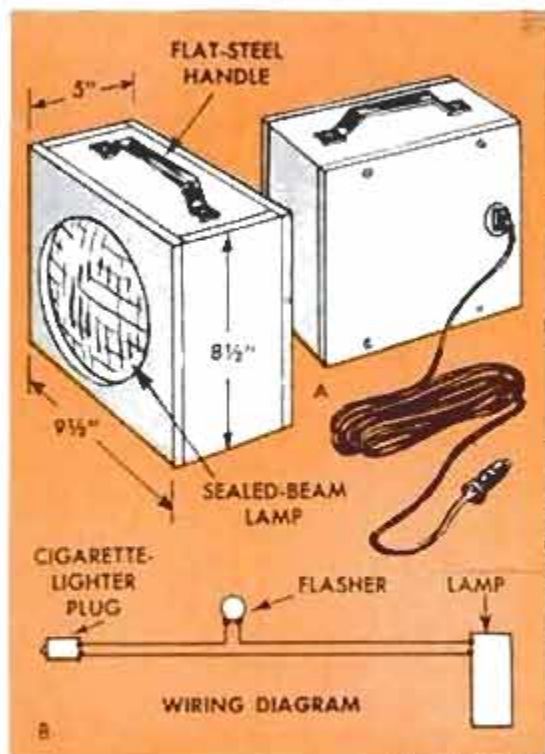
Alcohol-water injector.

You may have noticed that engines are less likely to knock in rainy weather. It is well established that high humidity in the air entering the engine has an effect similar to a high octane number. Consequently, when water or, better yet, an alco-

hol-water mixture, is injected into the intake manifold, an engine will run without knocking on gasoline of a lower octane than usually required. In some cars, an injector might permit the use of regular gasoline instead of premium, but it would take

(Continued to page 254)

Trouble Lamp From Sealed-Beam Light Housed In Carrying Case



Housed in a carrying case fitted with a carrying handle, a discarded sealed-beam headlight provides a good trouble lamp. Use a light with one element still working. The case may be made of $\frac{3}{8}$ -in. plywood. One side is cut out slightly smaller than the lamp, which then is mounted over the opening with metal straps across the upper

and lower sides. Wire the lamp to a female plug mounted on the back and fit an extension cord with a male plug at one end and a cigarette-lighter plug at the other end. A piece of red plastic over the lamp and a flasher in the line will convert the lamp to a warning light.

J. Russell Krupps, Mill Hall, Pa.

Several Factors Can be Responsible for Rough Idling of Engine

When an automobile engine idles roughly, first check to make sure the spark-plug wires are separated far enough to prevent cross fire. Then adjust the carburetor and inspect it for air leaks. Old rubber boots

on spark plugs may be conductive and cause shorting outside the plugs. Finally, check the heat-riser valve. If it is frozen shut, it will cause a back pressure that will prevent proper running of the engine.

Efficient Engine Operation Requires Clean Fuel Filter

If the engine of your car seems to lose power and "surges"—intermittently speeds up, then slows down—check the fuel filter and sediment bowl of the fuel pump before having the carburetor overhauled. Extreme temperature changes during winter weather tend to cause formation of water in the gasoline tank. This water, plus sediment, will partially block the screens in the fuel pump and the element in the filter. Clean the sediment bowls and filter elements then add a quality fuel-system demoisurizer to the gasoline tank to prevent further trouble.





RERINGING THOSE PISTONS

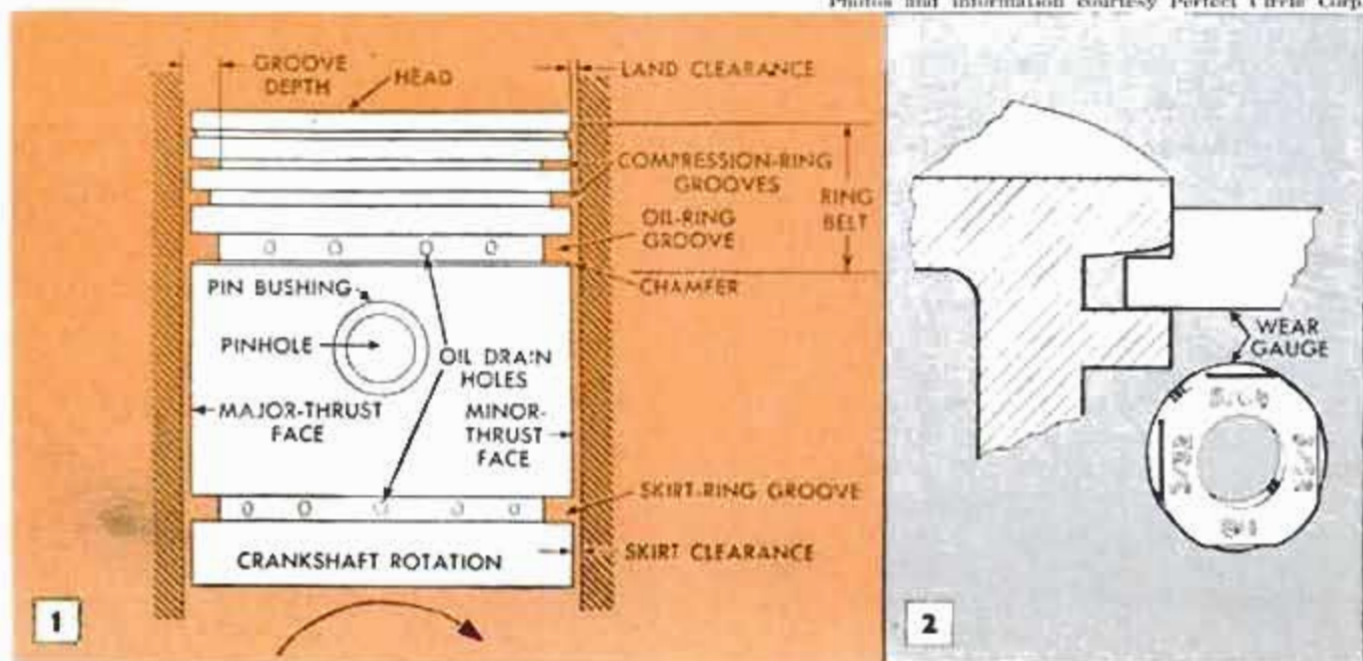
is only part of the job. You'll also have to check the pistons, cylinders, bearings, wrist pins and cooling system

TO ASSURE maximum effectiveness, new piston rings should be installed in an automobile engine only as part of a complete overhaul. Rings alone seldom will eliminate excessive oil consumption in a worn engine. For example, loose connecting-rod bearings will throw too much oil up onto the cylinder walls. Even new rings cannot control this excess, Fig. 9, and the oil will be burned along with the fuel-air charge in the combustion chamber. Worn,

wrist-pin bushings also allow an oversupply of oil to be forced onto the cylinder walls where it is wasted.

If an engine has a tendency to overheat, the cooling system must be flushed, timing set correctly or the carburetor overhauled to provide the correct fuel-air mixture, to eliminate the heating problem before the overhaul is started. Even when an engine is in good condition it will tend to operate at somewhat higher-than-normal tempera-

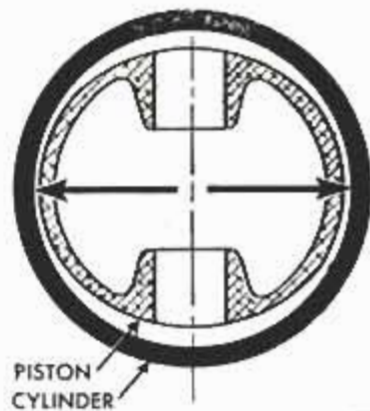
Photos and information courtesy Perfect Circle Corp.



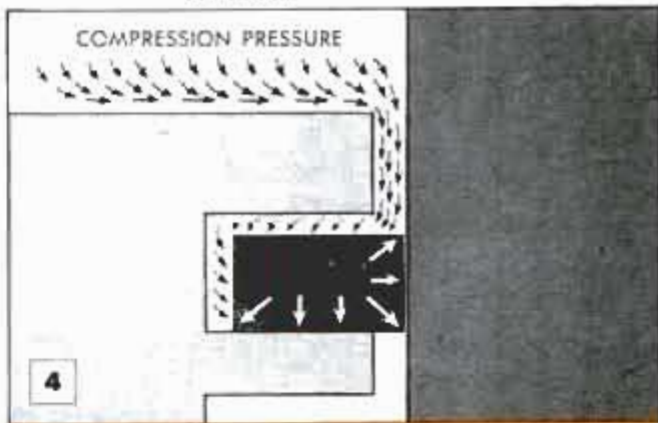
tures after tight-fitting new parts have been installed. Because of this, an engine that has been overheating will almost certainly run much too hot after an overhaul. The heat will destroy the oil film between the new rings and the cylinder walls, and scored or scuffed cylinders and pistons will result. The cylinders then will have to be rebored and new, oversize pistons installed.

A good reringing job begins after the head, or heads, and oil pan have been removed, but before the pistons are pulled. Due to ring wear on the cylinder walls there will be a shoulder at the upper end of each cylinder, Fig. 5. This shoulder must be removed before the pistons are taken out. It is true that a piston with its old rings probably can be pulled past the shoulder; there also is the chance that a ring land, Fig. 1, will be broken and the piston ruined. If new rings are installed without removal of the shoulder, the top ring will be broken during the first few revolutions of the engine when the square edge of the new ring slams against the radius of the shoulder. Use a proper reamer, and extend the reaming no more than $\frac{1}{32}$ in. onto the ring-worn area, keeping it flush with that surface.

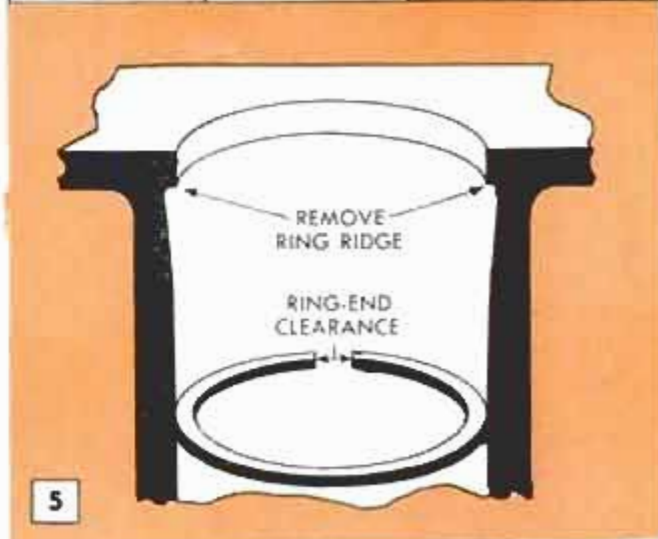
After the pistons have been pulled from the block and the old rings removed, the ring grooves are cleaned and the top groove of each piston is gauged. If a regular wear gauge is available, Fig. 2, it is used as indicated. If none is available, install the new top ring and insert a .006-in. feeler gauge between the ring and the groove. If the gauge will enter more than $\frac{1}{16}$ in. in from the edge of the ring land, the groove should be machined to accept an insert, a ring and spacer, or the piston should be replaced with a new one. If the piston is aluminum, of the type that has a steel insert in the top-ring groove, also gauge the second groove, as it will wear



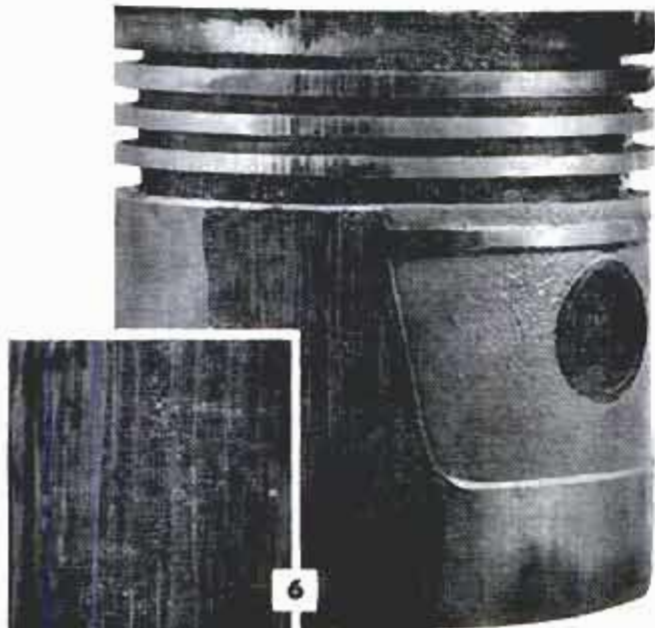
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4



5



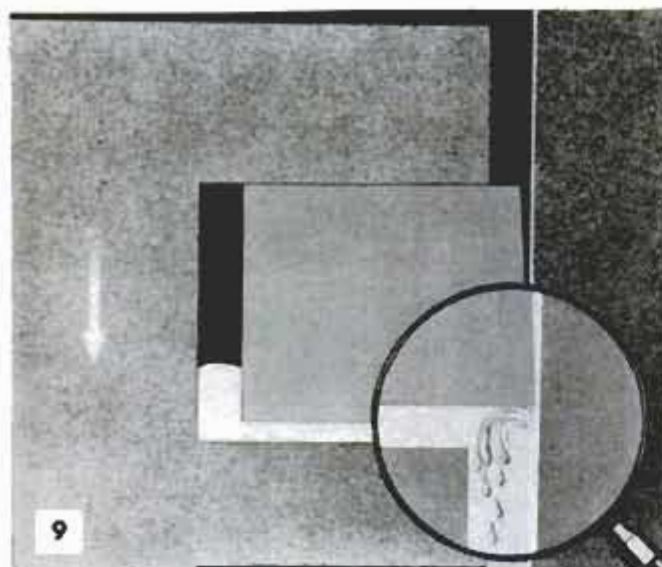
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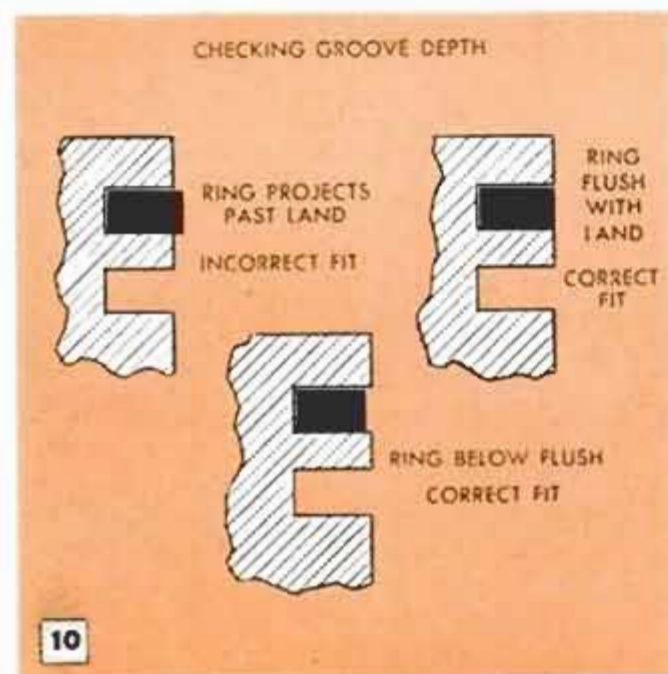
7



8 Above, twisting ring as shown, when installing it on the piston, will completely destroy its effectiveness



9 Above, on downstroke of piston, lower edges of rings scrape off excess oil, leave thin film for lubrication. Below, new ring checks depth of ring groove



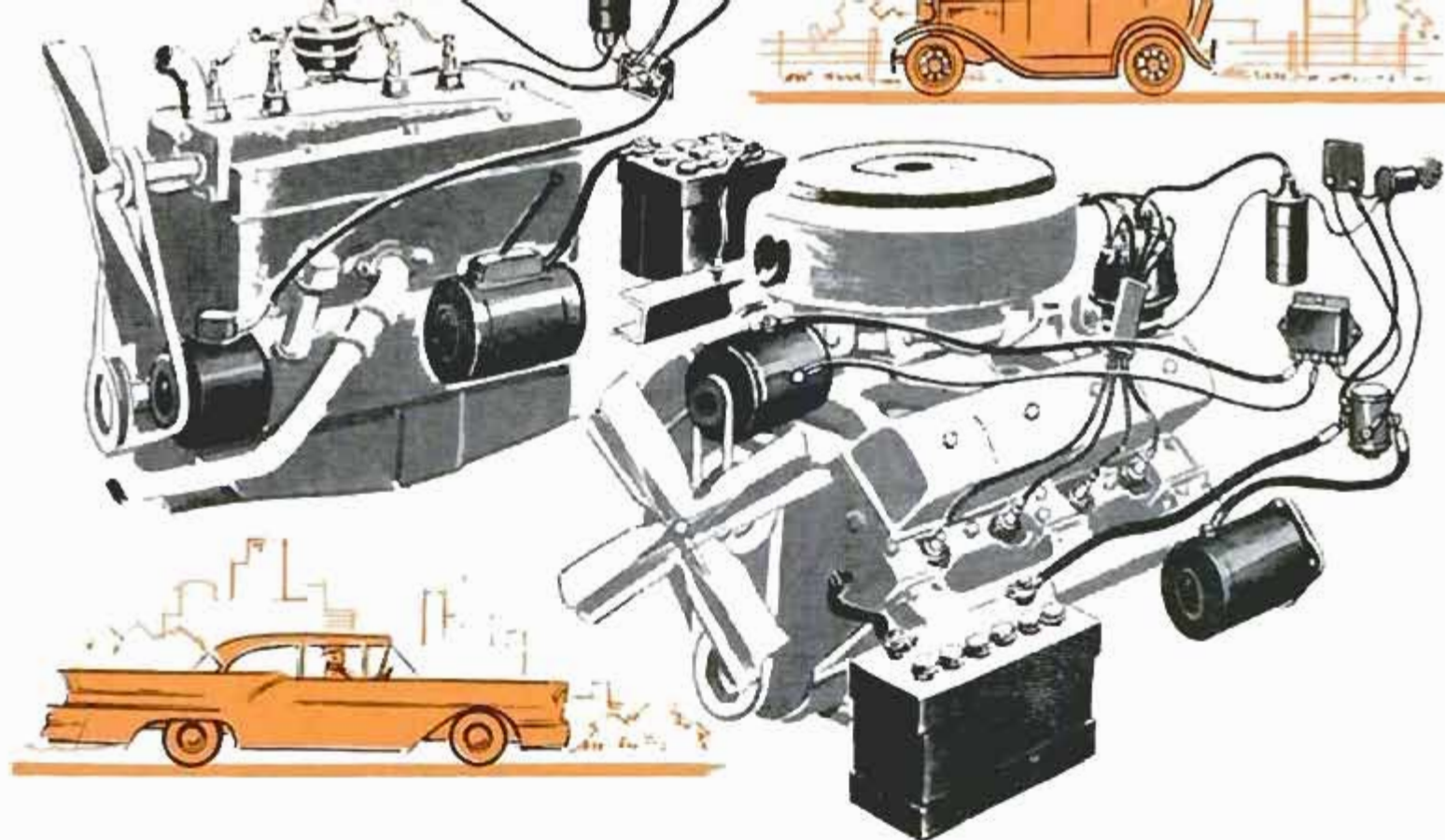
10

more rapidly than the first ring groove does. The new rings now are checked against the pistons and the cylinders. The top, or compression ring, is fitted into the top-ring groove on the piston and the groove depth is checked, Fig. 10. If the rubbing surface of the ring is flush or below the surface of the ring land, the ring is the correct one. If the ring projects, it is the incorrect size. A compression ring now is fitted into each cylinder, being pushed down to the lower end of the cylinder at the point of least wear by using an inverted piston. The piston also aligns the ring squarely in the cylinder. If the clearance at the ends of the ring is less than specified in the manufacturer's instructions that are packaged with the rings, the ring set is wrong for that particular cylinder. Insufficient ring-end clearance will allow the ends to contact when the ring expands with heat. The ring will either break or jam out against the cylinder wall and cause scoring.

Although thin steel piston rings can be spiraled onto a piston, cast-iron compression rings and oil-control rings must not be twisted as is being done in Fig. 8. A cast-iron ring distorted in this manner will not lie flat in the ring groove to seal compression pressures. Fig. 4 shows how compression acts to seal itself above a piston by forcing the piston rings down in their grooves and out against the cylinder wall.

If any piston has to be replaced, the new piston must be fitted into the cylinder and checked for proper size and clearance. Because aluminum pistons, used in most automobile engines today, expand at a greater rate than the cast-iron engine block, sufficient clearance must be present between the pistons and cylinders to allow for the difference. One method of providing this expansion differential is to make the pistons "cam ground" in shape. This means that the diameter of such pistons is greater at right angles to the wrist pin than parallel to the pin, as in Fig. 3. The greater amount of piston expansion then moves along the wrist pin. When checking the fit of a piston in a cylinder, the piston is moved down to the lower end of the cylinder and a feeler gauge slipped between cylinder and piston. Clearance should conform to the specifications of the engine manufacturer. If a piston that is too large is installed, it will expand and "seize" when heated. The result will be a piston that looks like the one in Fig. 7.

Proper piston clearance also is affected by the fit of the wrist pin. If the pin is fitted too tightly, when it expands from heat it will distort the piston and cause it to expand at right angles to the length of the pin. Fig. 6 demonstrates what happens to a piston under such a situation. ★ ★ ★



DO YOU KNOW IGNITION?

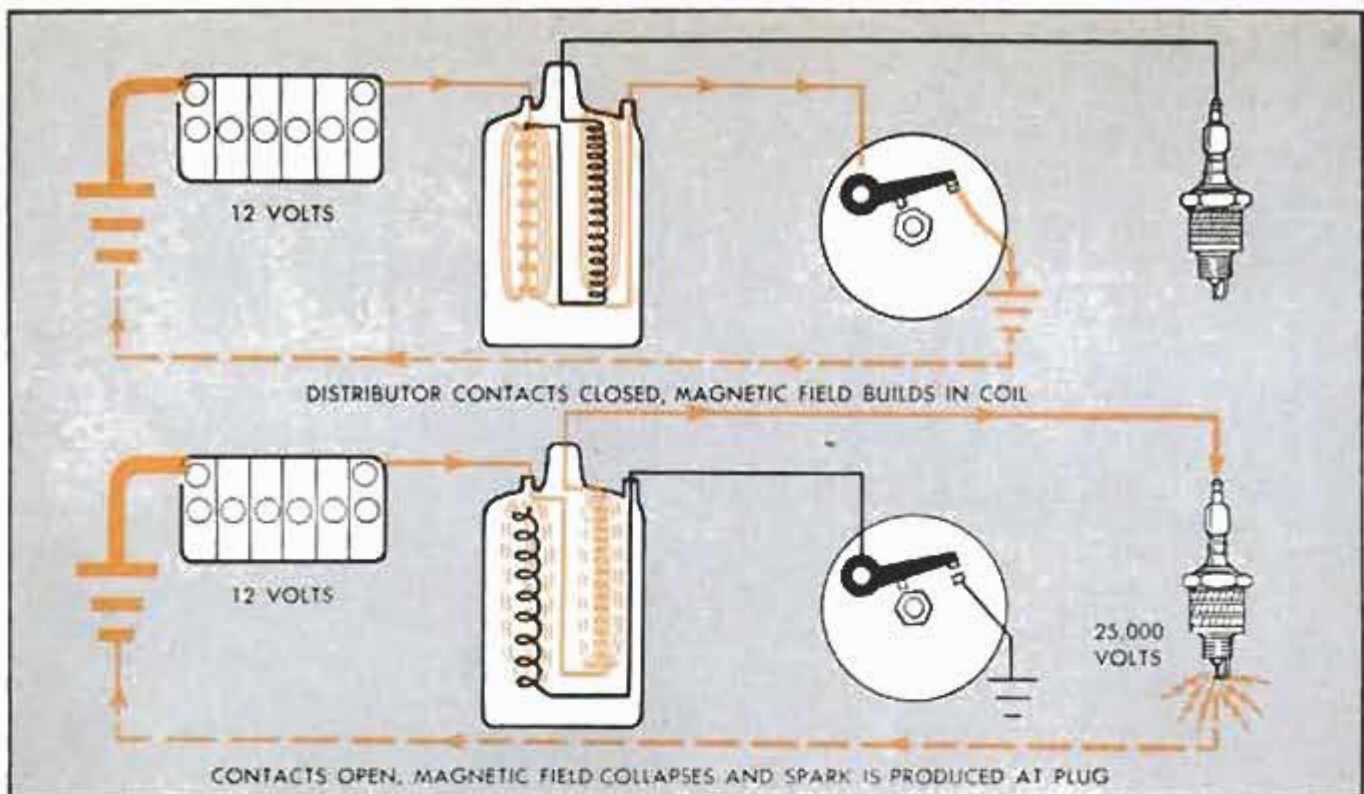
By Jay W. Hedden

IF YOU BELIEVE your new Super Duper V8 300-hp.-engine car has nothing in common with its brother of the '20s, look at the ignition systems above. Both the 4-cylinder engine that produced about 25 hp. in the '20s and the 300-plus-hp. engine of today have ignition systems with identical components. Refinements have increased the reliability of the units, but essentially the battery ignition system used in the '20s is the one used today.

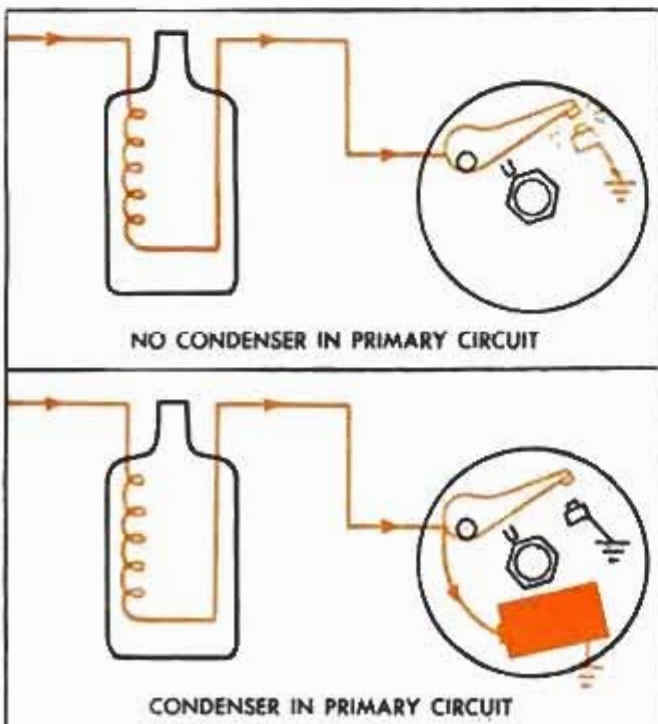
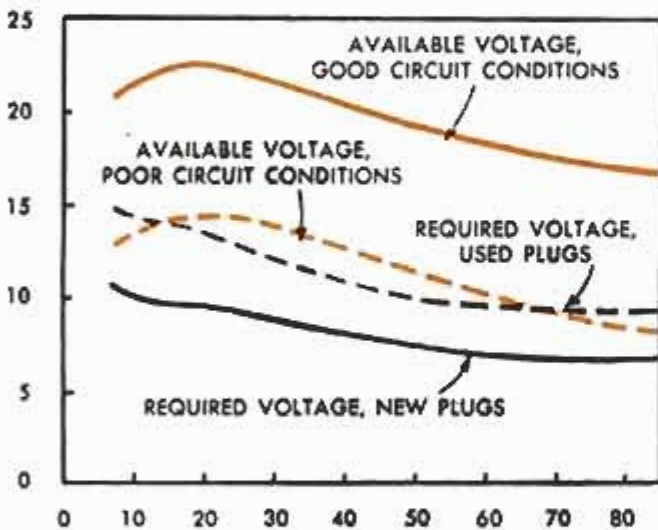
Test equipment has made diagnosing of ignition problems much simpler for the modern-day mechanic, but correcting the problems requires the same know-how used by old-time mechanics. As an example: In the old days a mechanic shorted out each spark plug to determine which were not firing. Today, an oscilloscope might be used to show which plug is misfiring. However, after the plugs are removed from the engine, the mechanic must determine *why* the plug is not firing.

To refresh our memories, let's go through the ignition system, diagram top of page 190, to see how it works. When the ignition switch is turned on, current from a battery—6 or 12-volt—flows into a coil that transforms low battery voltage to high voltage. To finish this circuit another switch also

must be closed—the distributor contact points. With the points closed, current flows through the primary side of the coil, which consists of a few hundred turns of relatively heavy wire. A magnetic field is built up around the wire, but not instantaneously. A fraction of a second is required. The value of the magnetic field is determined by the resistance in the wire, the inductance of the winding and the length of time the points are closed. In actual operation, the magnetic field seldom reaches maximum because the points are closed only a short time. When the points open, the current in the primary circuit from the battery tends to become less. Due to an electrical phenomenon—varying voltage in a circuit causes an induced voltage—induced voltage tends to keep the current flowing in an arc across the gap formed as the points open. Ordinarily, current flow would reduce gradually as the gap widened. This slow reduction of current would not collapse the magnetic field in the coil quickly enough to produce the required high voltage, and arcing would quickly burn out the points. The condenser now does its job, as in the diagram at the left. When the points open, current that keeps flowing goes into the condenser. By



Information courtesy Electric Auto-Lite Co.,
Champion Spark Plug Co., Delco-Remy Corp.



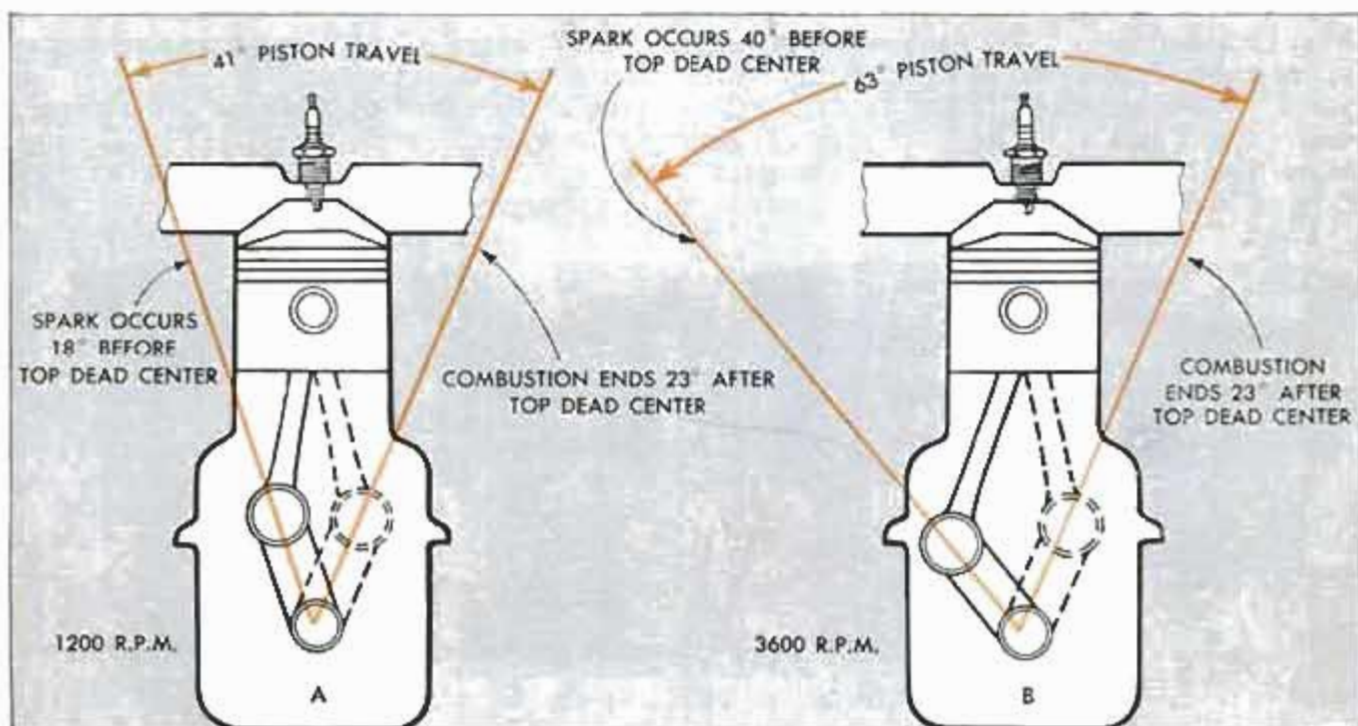
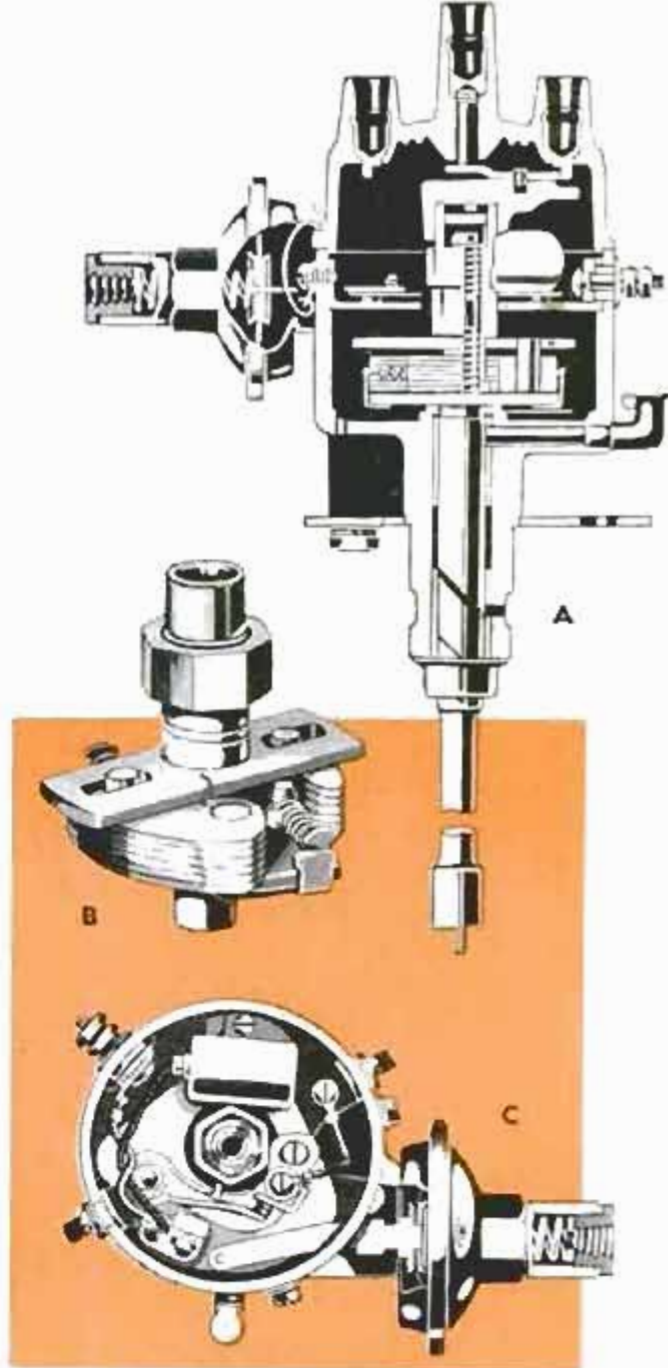
the time it is fully charged, and ready to discharge, the points have opened far enough to prevent an arc. The primary current stops quickly, the lines of magnetic force collapse quickly across the several thousand turns of fine wire in the secondary winding in the coil and high voltage is induced in the secondary circuit. Under ideal conditions when the points open, voltage in the secondary circuit may reach 25,000 volts. In actual operation, when sufficient voltage is reached to jump the spark-plug gap—usually between 4000 and 10,000 volts—voltage drops off. An oscilloscope will show that this voltage drop is relatively slow. Called the inductive component, this latter part of the spark does not aid in firing the fuel-air mixture, but does cause electrical interference and severe erosion on the spark-plug electrodes. For this reason, resistor spark plugs, with a built-in resistance that chokes off most of the unwanted inductive spark, have longer electrode life and reduce electrical interference. Because the inductive portion of the spark makes the brightest flash, eliminating that part will produce a spark with much less light. It can be understood, then, that brightness of spark does not necessarily indicate that one plug is better than another in its operation in an engine.

Spark plugs too often are blamed for trouble that actually can be traced to other components of the ignition system. If the coil is connected incorrectly so polarity is reversed, from 20 to 40 percent more current will be required to produce the required voltage at the spark plugs. No matter which way the battery in a car is grounded, current to the plugs is negative,

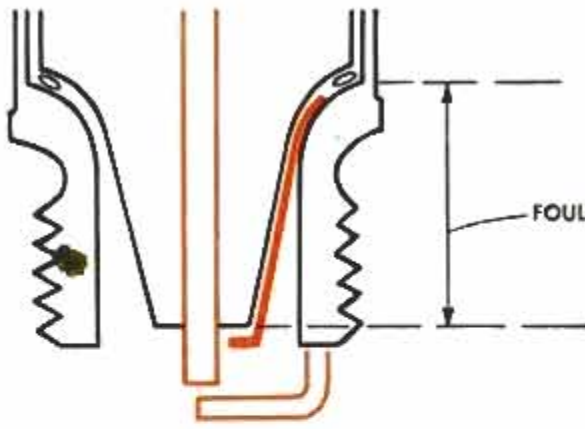
as this causes the spark to jump from the center electrode to ground. Lower voltage is required because electrons will flow more readily from the hotter center electrode. Badly burned distributor contact points will cause plugs to misfire. The burning of the points, in turn, may be caused by a voltage regulator that is set for excessive voltage.

Because today's powerful V8 engines are frequently driven at slow speeds in traffic where only part of their power is required, lead deposits from gasoline tend to condense on the surfaces in the combustion chamber, including the spark-plug insulator. When the car then is driven at high speeds on the highway, or suddenly accelerated, the resulting increase in heat melts the deposits and they become conductive, shorting out the plugs. Sometimes the plugs can be sandblasted clean and regapped. To help overcome this problem, additives now are used in gasoline, and spark-plug makers have produced plugs with extended insulators that project into the combustion chamber. At low speeds exhaust gases keep the insulator hot and burn away deposits. At high speeds the insulators are kept cool by the intruding fresh fuel-air mixture to prevent preignition. These plugs are available in various heat ranges that must be selected for a particular engine. These plugs are used in overhead-valve engines only. In valve-in-block engines the extended insulators might be struck by valves or pistons. The extended insulators on these plugs also provide a longer fouling path, as in the diagram above. This longer path presents greater resistance to passage of current, preventing misfiring.

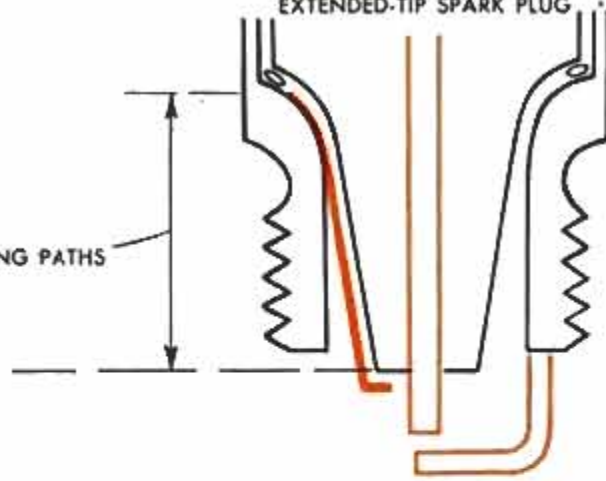
Four reaches, or thread lengths, are available in spark plugs, as in the photo



CONVENTIONAL-TIP SPARK PLUG



EXTENDED-TIP SPARK PLUG



below. Should a long-reach plug be used in an engine requiring a short-reach type, a valve or piston could hit the plug end. Also, the exposed threads would glow and cause preignition. Removing the plug would be difficult when the threads filled with deposits. In the opposite instance, a short-reach plug in a long-reach cylinder head would be so shrouded it could not properly ignite the fuel-air mixture. Exposed threads in this case would be in the head. Installing the proper plugs would be difficult if the threads in the head were filled with deposits.

The distributor, top of page 191, is the device used to distribute the high-voltage current to the plugs by means of a rotor. The points, and usually the condenser also, are located in the distributor. The high-voltage current must be delivered to each spark plug at the proper moment. The correct time of firing will vary with engine speed, engine load and other factors. So there must be a means of changing spark timing. For maximum power, combustion must be completed by the time the piston reaches about 20 deg. after top dead center. Details at the bottom of page 191 show an engine that is assumed to be designed so that combustion ends at 23 deg. after T.D.C. for most efficient combustion. Detail A shows that at 1200 r.p.m. the ignition must occur at 18 deg. before T.D.C. if combustion

is to be completed at 23 deg. after T.D.C. When the engine is speeded up to 3600 r.p.m. as in detail B, it is necessary to advance the spark to 40 deg. before T.D.C. (gasoline burns at a fairly constant rate). To obtain spark advance, distributors have a centrifugal-advance mechanism, detail B, page 191, consisting of spring-loaded weights that are thrown out to advance the breaker-plate cam as engine speed increases. Under part-throttle operation there is a high vacuum created in the intake manifold. The fuel-air charge is not so highly compressed and burns more slowly. An additional spark advance will increase fuel economy, so a vacuum-advance device, detail C, provides this. A diaphragm is connected to the breaker-point plate by a lever. The opposite side of the diaphragm is connected to a passage in the carburetor by a copper tube. The passage in the carburetor is on the atmospheric side of the throttle plate, and when the throttle opens, the passage is under manifold vacuum. The diaphragm then moves the breaker plate to advance the spark according to the amount of vacuum. A spring returns the diaphragm to a neutral position when vacuum reduces. Available voltage from the battery, as shown in the chart on page 190, determines ignition efficiency. Loose connections lower available voltage, worn plugs and burned points increase required voltage. ★ ★ ★





DROP-LEAF TABLE

By John Bergen

DESIGNED for that dining alcove that must serve as a dining room when entertaining, this king-size, drop-leaf dining table folds and rolls and takes its place against the wall when not in use. It opens into a table 40 x 60 in., seating six persons nicely. Brass posts give it just the accent needed to enhance the elegant sweep of its teakwood or African-mahogany top.

Construction is simple. The swinging legs are made alike and in pairs from 1 $\frac{3}{4}$ -in. stock, 2 $\frac{1}{4}$ -in.-wide pieces being used at the tops, 2 $\frac{1}{2}$ -in. pieces at the sides and 4-in. pieces as the bottom. These U-shaped assemblies are half-lapped at the corners and glued. Holes for the brass posts are bored 1 in. deep and holes for caster sockets are drilled 1 $\frac{5}{8}$ in. deep. Rounding the ends of the members is a simple job if you have a disk sander. A rasp and sandpaper attached to a flat board will do the trick,

however, when working with hand tools. In each case, the radius should be marked on top and bottom edges beforehand. Even with a disk sander, final sanding should be done with a sanding block to blend the rounded ends into the face grain. When

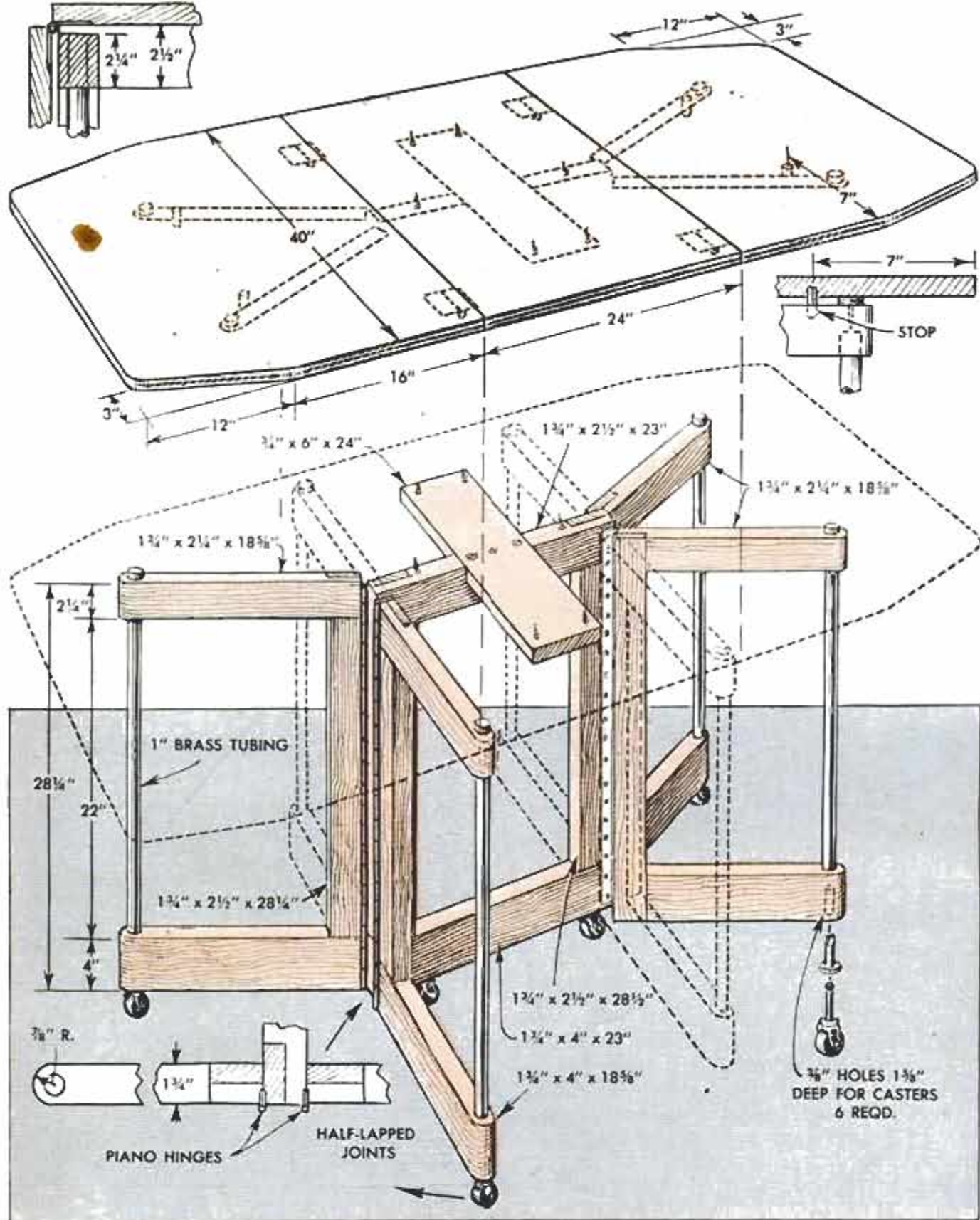
MATERIAL LIST

CABINET PLYWOOD

- 1 pc.— $\frac{3}{4}$ " x 24" x 40"—Top
- 2 pcs.— $\frac{3}{4}$ " x 28" x 40"—Drop leaves

LUMBER

- 2 pcs.—1 $\frac{3}{4}$ " x 2 $\frac{1}{2}$ " x 28 $\frac{1}{2}$ "—Center pedestal ends
- 1 pc.—1 $\frac{3}{4}$ " x 4" x 23"—Center pedestal base
- 1 pc.—1 $\frac{3}{4}$ " x 2 $\frac{1}{2}$ " x 23"—Center pedestal top
- 1 pc.— $\frac{3}{4}$ " x 6" x 24"—Top cleat
- 1 pc.—1 $\frac{3}{4}$ " x 2 $\frac{1}{2}$ " x 28 $\frac{1}{4}$ "—Pedestal hinge posts
- 4 pcs.—1 $\frac{3}{4}$ " x 4" x 18 $\frac{5}{8}$ "—Side pedestal bases
- 4 pcs.—1 $\frac{3}{4}$ " x 2 $\frac{1}{4}$ " x 18 $\frac{5}{8}$ "—Side pedestal tops
- 4 pcs.—1" O. D. brass tubing 24 $\frac{1}{4}$ " long—Pedestal pillars
- 4—Continuous piano hinges 28 $\frac{1}{2}$ " long
- 4—Open butt hinges (3" x 2") with spun pins
- 6—1 $\frac{1}{4}$ " dia. castors



assembling the members, remember the brass posts must be in place before the corners are lapped, glued and clamped.

If you have difficulty finding brass tubing, you can use 1-in. hardwood dowels instead. In picking them out, select four that are as straight as you can find. The best way to do this is to roll each dowel over a flat surface. Any bow or twist in the dowel can be detected right away.

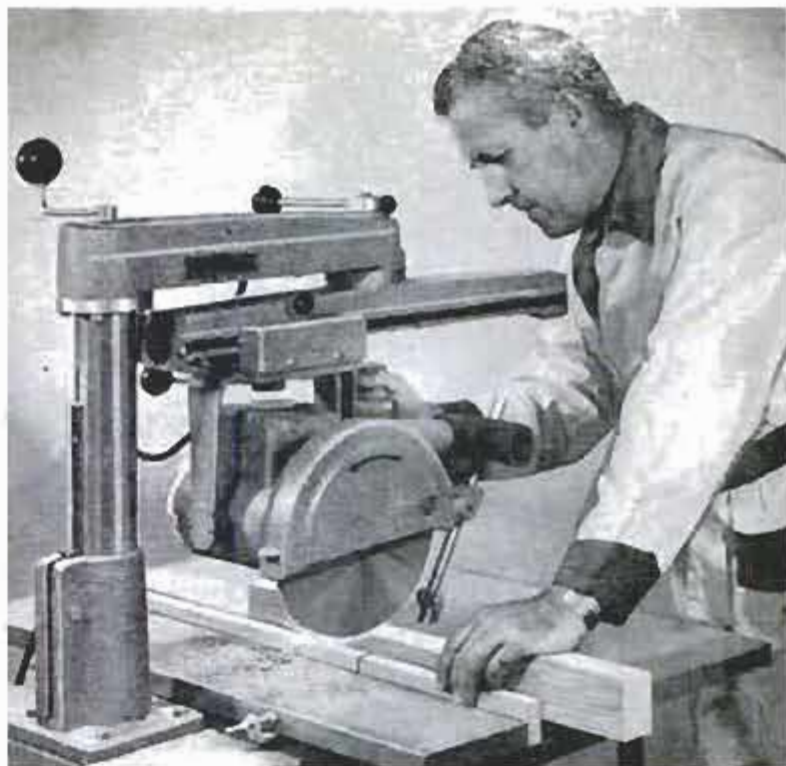
The center framework to which the

swinging legs are hinged with piano hinges, is made $\frac{1}{4}$ -in. higher, or $28\frac{1}{2}$ in. This is done to allow for the thickness of the felt-covered furniture glides which are driven into the upper corners of the swinging legs. You'll notice that the top member of the center frame is dadoed for a $\frac{3}{4}$ -in. flat board, and that counterbored holes are drilled from the underside for two of the six screws which are used to fasten the table top. Like the legs, the members are

half-lapped at the corners. Holes for two caster sockets are made in the bottom.

The three-section top is made of $\frac{3}{4}$ -in. veneer-faced plywood, the edges of which are later covered with veneer tape to hide the plies. Holes for dowel-pin stops are made on the underside of the table leaves 7 in. in from the edges. Bore these not more than $\frac{1}{2}$ in. deep and use a twist drill so the point won't poke through the top surface. The stops limit the swing of the leg supports and automatically align them. The butt hinges which are used to hinge the leaves should be mortised flush into the underside and the hinge pins should be positioned a bit off-center to allow for finish. Use short enough screws in attaching the top to the understructure so there is no chance of the points breaking through the surface or even forming telltale bumps to mar it. Screws that are too long can be shortened by snipping off the ends.

A finish resulting very close in tone to that of the virgin wood can be obtained by using one of the new synthetic finishes, such as Satinlac. After a thorough sanding



and a close inspection of the work, particularly the top and leaves, to spot any flaws, apply a coat of lightener to the bare wood. After it dries, sand lightly and apply two coats of Satinlac. The resulting "natural" finish does not darken or yellow with age.

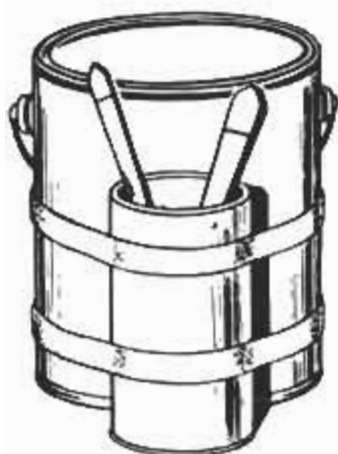
★ ★ ★

Stainless Lubricant in Stick Form Has Variety of Uses

Used much in the manner of a child's crayon, stainless lubricant in stick form is available for many uses around the home, shop and office. For zippers that are slightly difficult to work when a garment is returned from the cleaners, simply apply a light coat of the lubricant from the stick. Friction catches on cabinets, ranges and refrigerators work smoothly and easily when touched with a bit of the lubricant. Another use for the long-lasting, non-

staining material is to make double-hung sash slide easily. Doors that stick against the jamb also can be freed with the stick. If the bar of soap you keep in the toolbox for lubricating wood screws does not stay soft and usable, substitute a stick of lubricant that will never dry up and always is ready to help with the driving of wood screws. A touch of the stick to the cutting edges of saws, planes and other tools aids in smoother cutting.

Brush "Holster" on Paint Pail



Tape a small-diameter, rather tall food tin to the side of your paint pail. This tin is an ideal holder for smaller brushes used for trimming and edging. It will be especially handy when working at the top of a ladder. —P. E. Fitzpatrick, Gary, Ind.

Rubber Cement Seals Glass Jars

If you save small quantities of paint or other liquids in screw-top glass jars, make more certain that the liquids will be kept in good condition by sealing the jar. Apply rubber cement to the jar threads before turning on the top, as indicated.



Electric Starter for Model Plane

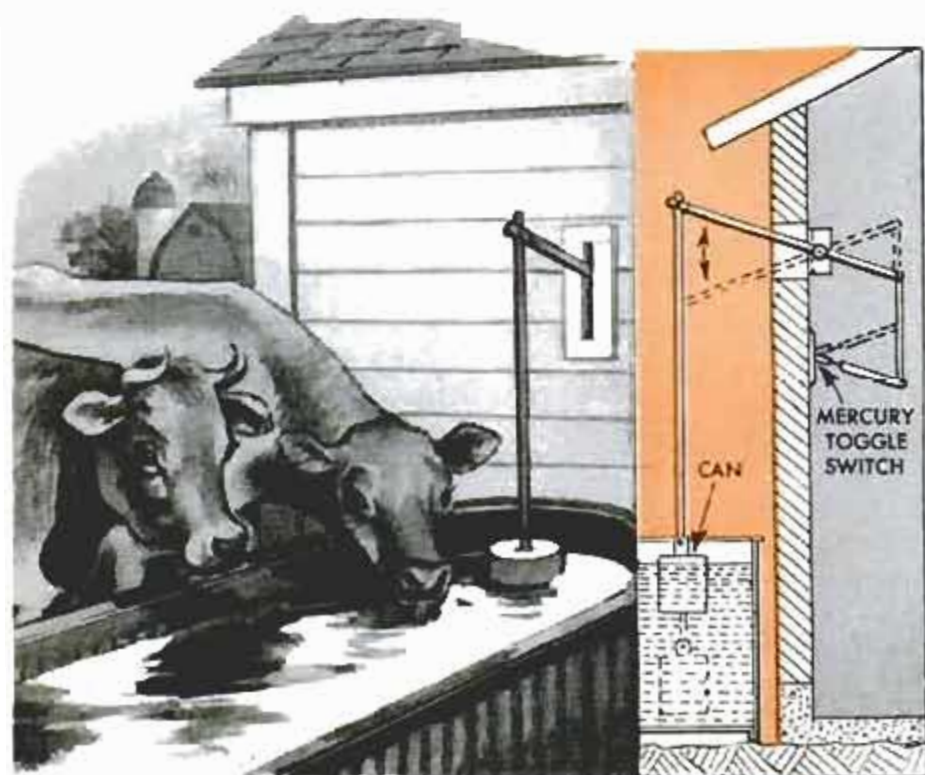
Rotating the propeller of a model airplane two or three hundred times to wind up its rubber-band "motor" can be a time consuming, wrist-tiring job. One father who was faced with this task for his young son cut a Y-shape from the hook portion of a wire coat hanger to make a "power winder" for the rubber-band motor. The wire device is chucked in a $\frac{1}{4}$ -in. electric drill and the winding operation then takes only seconds. — J. J. Mason, Lawton, Okla.



Data Taped to Grinder Housing Shows Correct Operating Speed

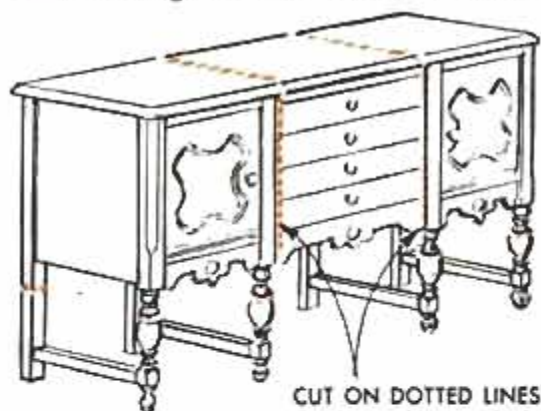
To avoid damage to the wheel and bearings, and to assure a good finish, lathe grinders must be driven at the correct speeds. High speed is used for external grinding, low speed for internal grinding. To minimize the chance of operating a grinder at the wrong speed, press a strip of tape to the grinder housing on which is indicated which speed is to be used.

Improved Float Arrangement Controls Electric Pump at Farm Well

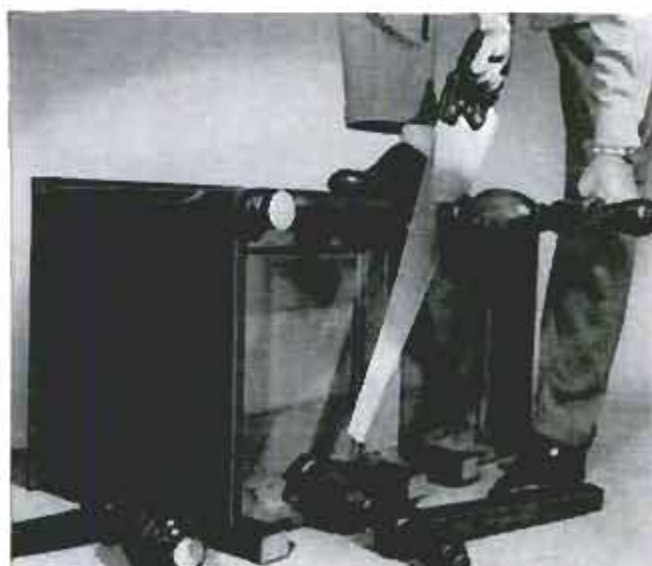


Requiring only occasional testing of the electrical circuits to make sure it is all right, this device was assembled by one farmer to make the filling of a stock-watering tank automatic. An empty 5-gal. oil can, soldered shut to be watertight, acts as a float to actuate a system of levers pivoted in a slot in the barn wall. Inside the barn the levers act on an extension screwed to the toggle of a mercury-type switch that controls the water pump. The switch is not spring-loaded, and the mercury mechanism is long-wearing. — Henry Josephs, Gardenville, Pa.

Old-Style Buffet Cut Apart to Make Modern Furniture



Long, oversize buffets that once were popular in dining rooms are too large to fit in modern dining areas that usually are fairly small. However, these pieces of furniture can be cut down and used for other purposes. In the example shown, the buffet was cut as indicated along the dotted lines to produce two end or lamp tables. The legs also were shortened to match the trend to lower furniture surfaces. The center section of the buffet contained drawers. These ready-made drawers are ideal for use in built-ins, or in any furniture built in the home workshop. Their size and shape might, for example, suggest a small piece of furniture that could be used in some particular location. When the buffet shown was modified, the center section of the top was refinished and fastened to the wall in a hallway. With a mirror mounted above it, it is the ideal spot to display fresh cut flowers. Save the portions of the turned legs that are removed. They might be just the thing for a low coffee table, or, with some slight modifications, could be used simply as decorative knobs or columns. If the newly ex-



posed sides of the sectioned buffet are of plywood or hardboard, cover them with a piece of hardwood-faced plywood to match the finish of the rest of the resulting end table, or with plastic veneer.

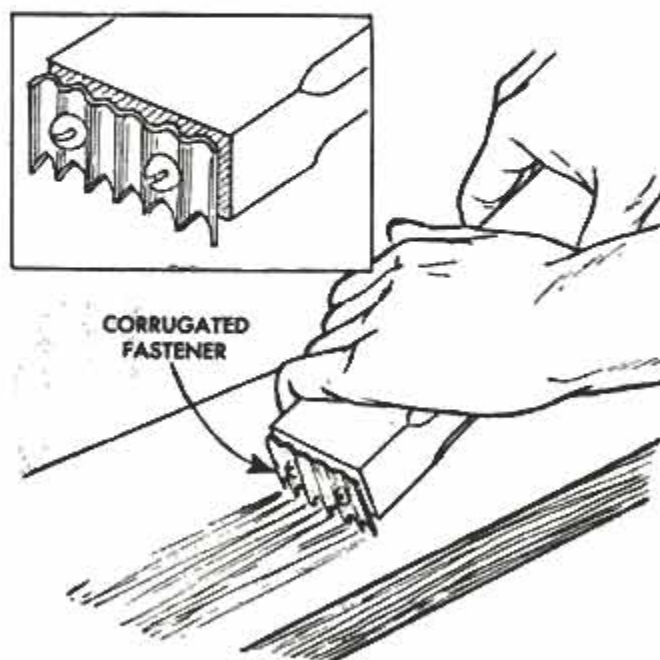
Fred Haitz, Sioux City, Iowa.

Tool Roughens Joint Surfaces For Better Glue Bond

Glue will form a better bond when the surfaces of wooden workpieces to be glued are roughened by a tool such as the one shown at right. To make the tool, drill two holes in a corrugated fastener and screw it to one end of a short length of wooden scrap as in the detail.

Norm Jacky, Fond du Lac, Wis.

To save steps when it is necessary to take medicines and miscellaneous articles to the bedside of a sick person, pin a shoe bag to the side of the bed so that most of the things desired by the patient are within easy reach. When used for children, do not place in the bag medicines that are to be administered under supervision.



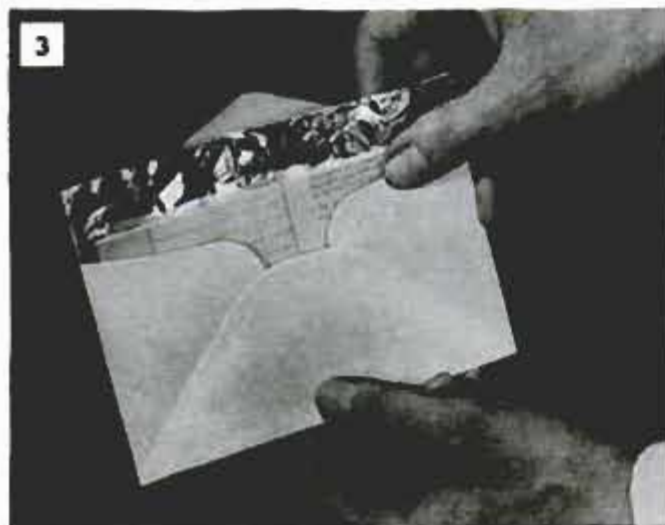
Solving HOME PROBLEMS



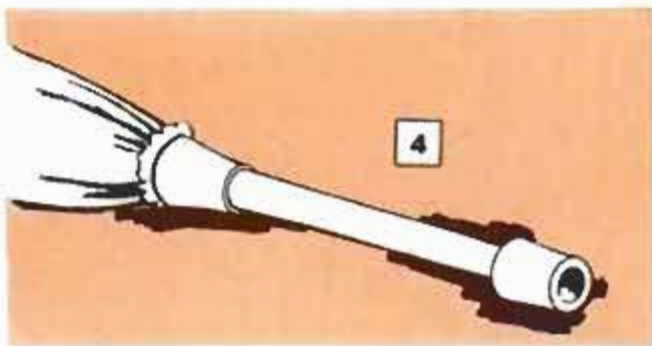
1. YOU WOULDN'T USE your best card table for this but an old one fitted with a plastic-screen top makes it quite simple to dry a sweater. The outline of the sweater is marked on the screen with chalk then washed and later spread out on the plastic screen to coincide with the chalked line



2. SHEET-METAL SCREWS are better than regular ones when it comes to fastening fixtures to thin material, such as hardboard and plywood facing on doors. The reason is that the threads on sheet-metal screws run right up to the heads of the screws which makes them hold their full length



3. WHEN MAILING CHECKS or cash or other material of a personal nature and you want to make the envelope lightproof to conceal the contents, cut a piece of aluminum foil to fit the envelope and slip it inside. It will make it "tamperproof" and add very little to the weight of the letter



4. MOST TIMES you can hang an umbrella by its handle when putting it away, but there is the occasion when it must stand in a corner. At such times it is worthwhile to have the umbrella spike tipped with a piece of hose to keep it from skidding

5. TALL TAPERS often become bent from the summer's heat. A quick way to straighten them is to wrap in cellophane and hold under hot water. This softens the candles, after which they are unwrapped and straightened by rolling with palm on flat surface

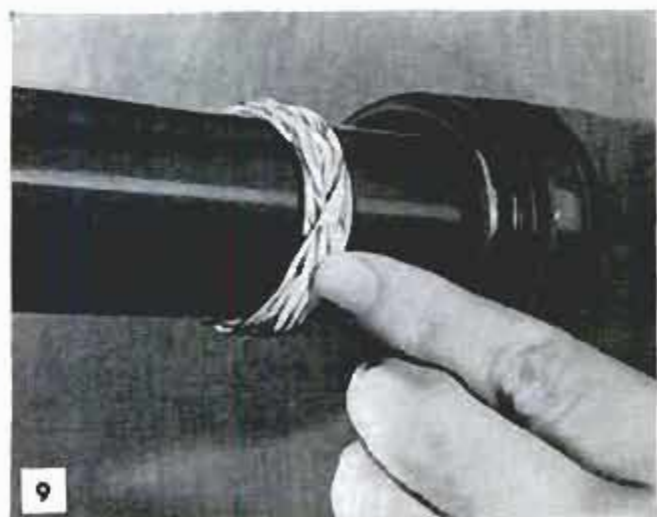
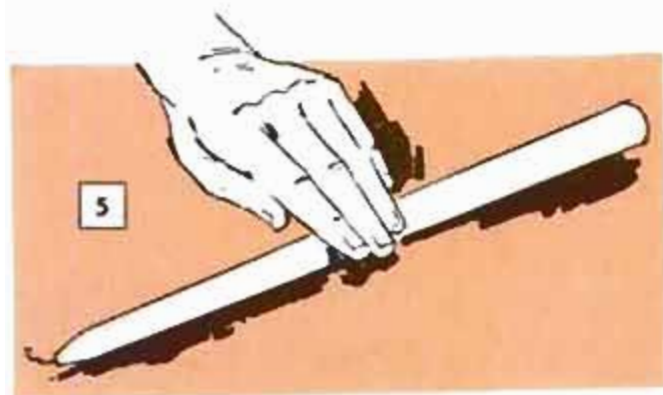
6. THE SHELF-PAPER EDGING on your cupboard or pantry shelves can be made to look like it is buttoned in place by cementing small buttons to the heads of thumbtacks. Spaced evenly along the edging, the buttons add a novel decorative touch

7. A DOORKNOB GUARD that keeps a small tot from opening an outside door and yet allows unrestricted use by other members of the family can be improvised from half a tin can attached to the inside. Tabs at one end permit attaching with screws

8. AN EXTRA FLASHLIGHT left in a clothes closet will prove itself handy when rummaging in the dark. A simple way to store it is to cut a notch in one of the shelves. A window turn button will keep it from being dislodged by shelf items

9. THE LAST SUIT OR GARMENT on the rod generally takes a beating in a crowded closet. A simple way to prevent this is to wrap rubber bands around the rod a few inches from each end to provide stops for the wire hangers. Use enough bands to form a ridge

10. NOVEL "MOSAIC" TREATMENT for the front of a small drawer or other object is to peel the color chips from outdated paint-color charts and glue them side by side in a brickwork pattern. A sealer coat of clear shellac is applied when the glue dries



Wire "Tongs" Speed Application Of Paint Stripes on Golf Balls

An easy way of marking golf balls for positive identification is to roll a stripe of brightly colored enamel on each of them from a freshly painted scrap of glass or metal as shown in the drawing at left. The small handle used for gripping and rolling the balls, is made from a length of steel wire that is pointed on both ends. The wire is then bent in half and twisted together, leaving enough of it straight at each end to form "tongs" with which to grasp a ball.

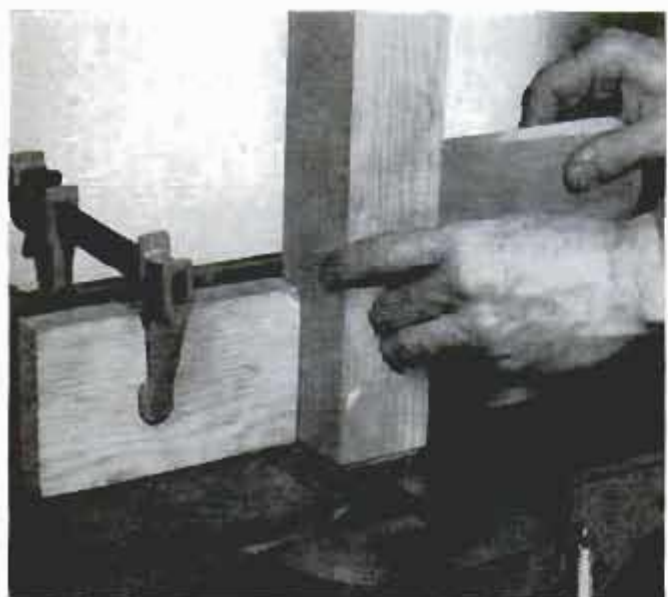
Before starting a project requiring the use of dowels, heat the dowel stock in a low to medium-warm oven to remove the moisture from the wood. This slightly reduces the diameter of the dowels so that they are easier to position in the work. Then, after being glued into position, the dowels absorb moisture again resulting in a tight fit. — M. Beasley, Jackson, Mich.



Block Clamped to Jointer Fence Permits Uniform Chamfered Cuts

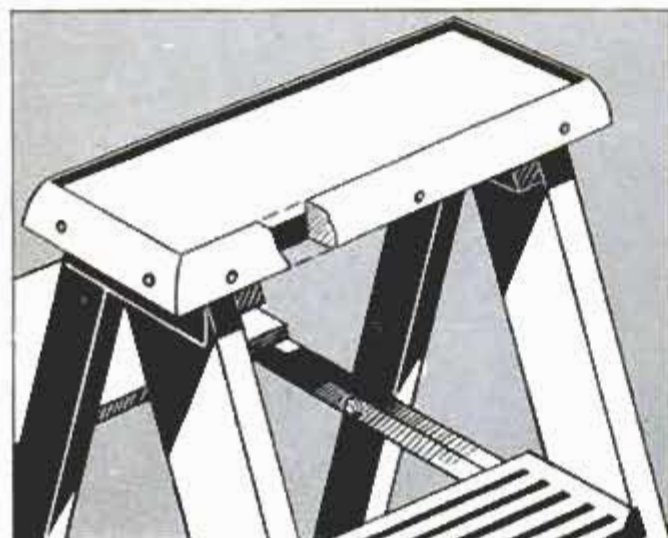
To permit chamfering the edges of several pieces of wood so that all chamfered cuts are uniform, clamp a stop block to the jointer fence in the position shown. The stock to be chamfered must be fed into the jointer knives so the latter cuts with the grain and not against it which would result in splintering and chipping. The chamfered cuts produced, of course, are slightly concave. For purposes of illustration only, the jointer is pictured incomplete and without a guard. Notice that a wide follow-up block is used to support the work vertically and rigidly.

E. R. Haan, Evanston, Ill.



Molding Strips Nailed to Ladder Top Retain Work Materials

Strips of quarter-round molding nailed to the edges of the top of a stepladder as shown at left, convert that surface into a handy tray for holding screws, nails, tools and small parts when working from the ladder. Wooden strips of other than quarter-round stock may be used for this purpose but the joints should be mitered for a good job. Use small finishing nails for attaching the strips to avoid splitting them or the ladder top, and to prevent catching clothing on the heads as might happen if common nails are used and the flat heads work out. Use stove bolts for attaching such strips to the top of an aluminum ladder.—Ted Fenn, Skokie, Ill.



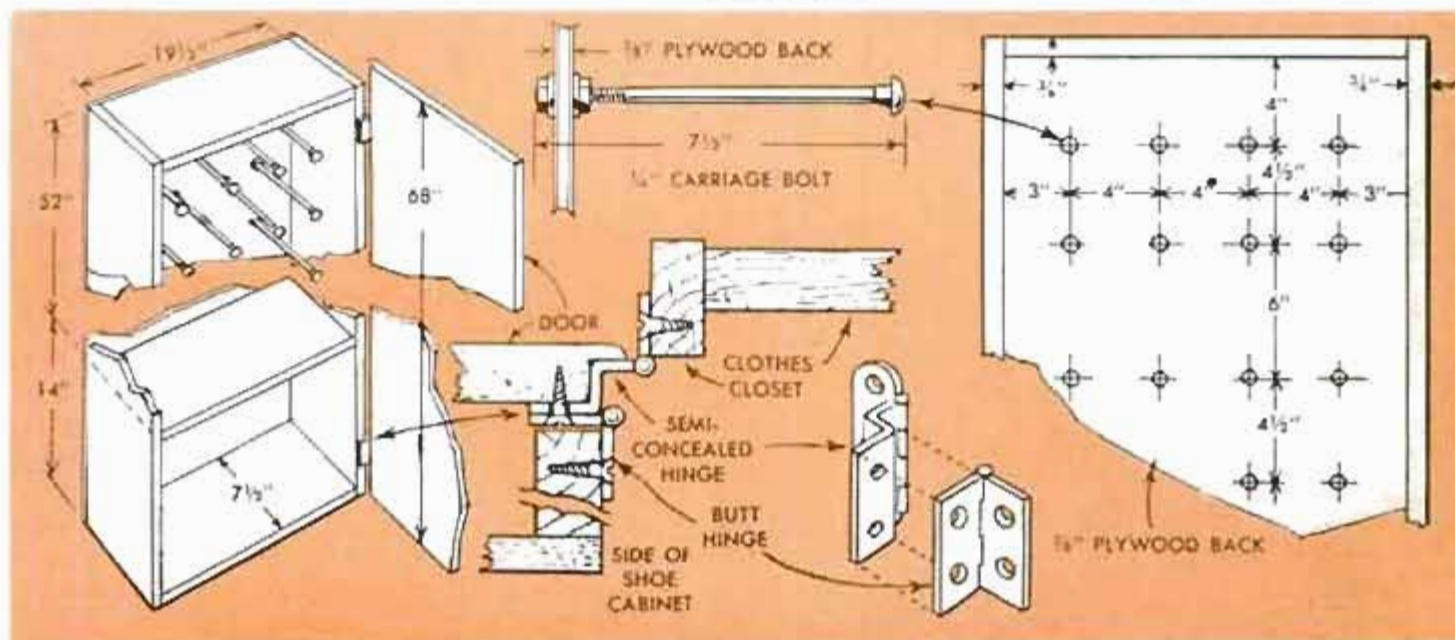
SHOE CABINETS

Hinged to Closet Doors

By Hi Sibley

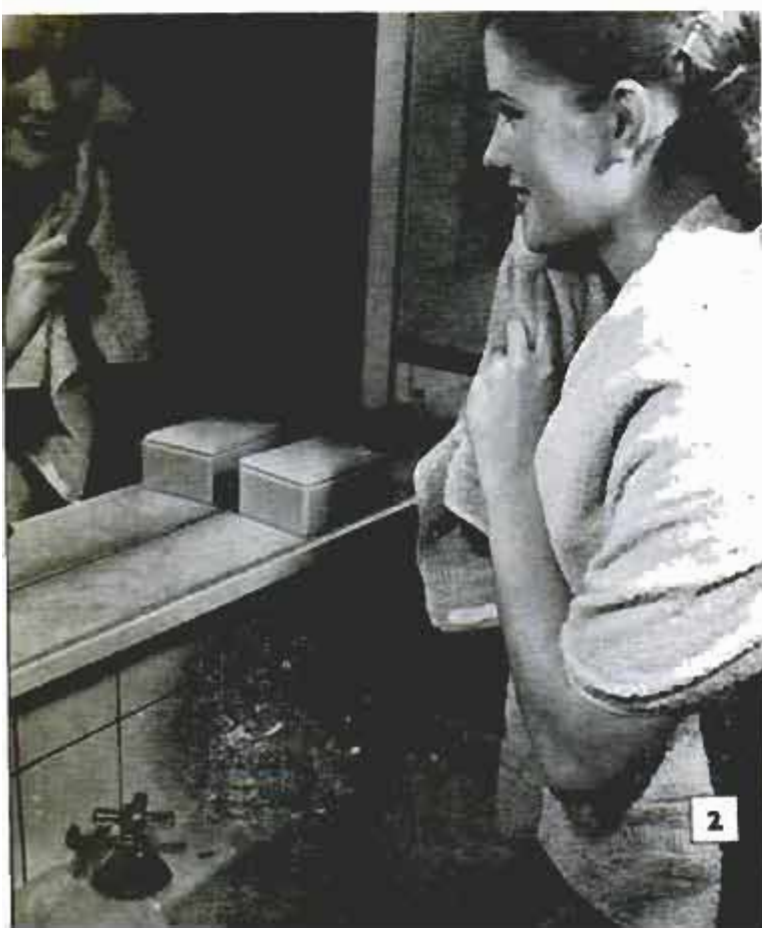
IF YOUR WIFE or daughters have been complaining of lack of closet space for shoes, here is a way of giving them the desired convenience without enlarging present closets or building new ones. Simply build shoe cabinets like the ones illustrated and attach them to existing closet doors by means of the hinge arrangement shown in the details. Friction catches keep the cabinets closed tightly when not in use to exclude dust and prevent interference with access to the closet. A single shoe cabinet may be added to a closet with one door by altering the height and width of the cabinet to suit. The spacing of the carriage bolts, that are used as pegs on which to hang the shoes, is adequate for most adult sizes, requiring two pegs for each pair of shoes. Men's shoes may be stored in the cabinets as well, except that there is space for only one shoe on each pair of pegs. The bolts that are used for pegs should be painted black, or left natural if cadmium-plated or galvanized. When tightening the bolts in place, turn outside nuts flush with the ends to guard against cuts from exposed threads.

A cubicle is provided in the bottom of each cabinet for footwear that cannot be hung on the pegs. The dimensions of this compartment may also be changed to best suit individual needs. Note that a closet that is to be provided with a shoe cabinet or cabinets must be of sufficient depth to permit clearance between the clothes and the cabinets when the doors are closed.



"LINOLEUMIZE"

Your Kitchen and Bathroom



A VAILABLE in a variety of colors, patterns and weights, linoleum is being used by many homemakers as a covering material for almost every surface in the home that receives hard use or is exposed to frequent soiling. Remnants that usually are obtainable at low cost from linoleum stores, are large enough for steps on hall and basement stairways, window cornices, doors and other small surfaces. The photos on this page and the next illustrate only a few of many such uses for linoleum. The next time you redecorate the bathroom or kitchen, consider using linoleum to cover all or part of the walls and other minor surfaces. Easy to work with adhesives and ready-made metal moldings that come in a wide selection of styles permit anyone to turn out professional-appearing work. ★★★

Fig. 1: For long service and easy cleaning, wax your linoleum only with preparation made especially for it. **Fig. 2:** Tile-patterned linoleum dado provides attractive, easily cleaned wall covering for lavatory

Fig. 3: Scarred and badly worn kitchen cabinets are given "face lifting" by covering of linoleum in solid color that contrasts with countertop and floor. Linoleum is cut to fit each door and drawer front and cemented in place



Fig. 4: Odd piece of linoleum is used for covering top of sewing table to provide smooth, easy-to-keep-clean surface that does not snag lightweight synthetic materials. Such pieces can be purchased as remnants at very low cost

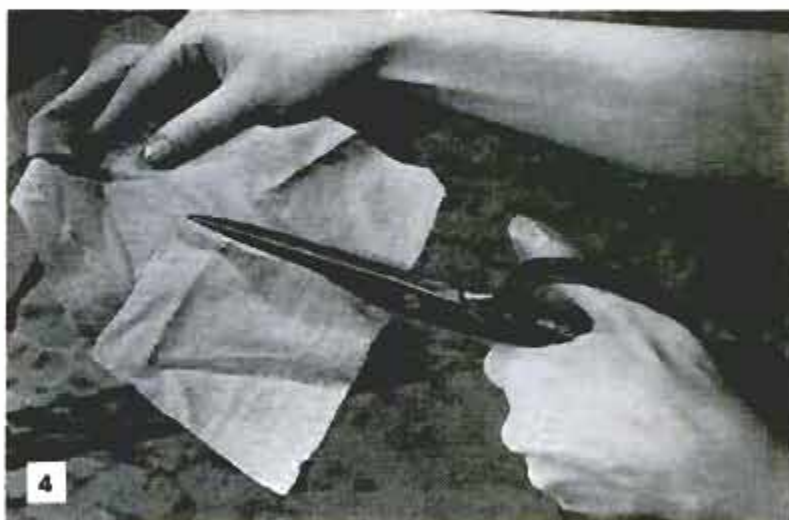


Fig. 5: Inlaid linoleum leftover strips are excellent for covering hall or basement steps to save them from the hard wear resulting from sand and other highly abrasive particles frequently tracked in from outdoors and workshop

Fig. 6: Attractive patterns and colors available in linoleum make it an excellent covering material for cornice to give interesting treatment to kitchen window. The smooth surface can be kept clean with very little effort

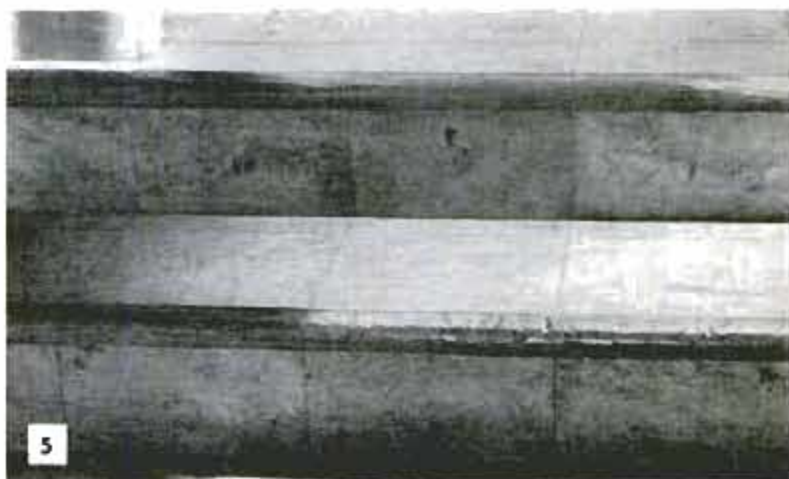


Fig. 7: Painted kitchen door was hard to keep clean until it was covered with linoleum in color that blends with doorway and upper half of walls. Edges of linoleum at side and bottom of door are beveled to prevent tearing it

Fig. 8: Desk top is covered with remnant piece of linoleum in solid, dark color. Edges of linoleum are beveled on all sides for attractive and serviceable writing surface. Ink stains and soil are easily removed with a damp cloth



Infant's Bed-Playpen Fits Between Front and Rear Seats of Car

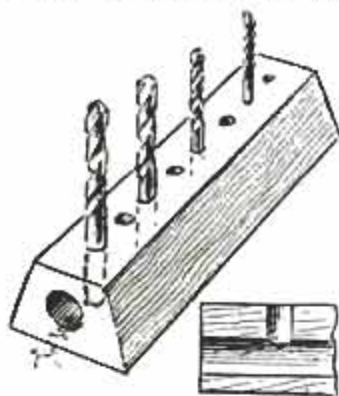


Auto travel with an infant is no problem when a car bed of the type shown is used. There is room for an older child at each side of the rear seat. Ends and bottom of the bed are cut from $\frac{1}{2}$ -in. plywood and the

side rails are $\frac{3}{4}$ x $1\frac{1}{2}$ -in. hardwood. The front end rests on the car floor and is cut to fit. The rear end is supported by flat-steel hooks over the rear seat.

M. C. Anderson, Arlington, Va.

Drill-Bit Rack Is Nonclogging



One craftsman who prefers to make his own drill racks from pieces of hardwood prevents the holes from becoming clogged simply by drilling a hole lengthwise through each block as detailed. This prevents sawdust

and other foreign matter from collecting in the holes that were drilled to hold the bits of various sizes. Blowing through the horizontal holes, or running a bottle brush through them prevents an accumulation of shop dust and dirt.

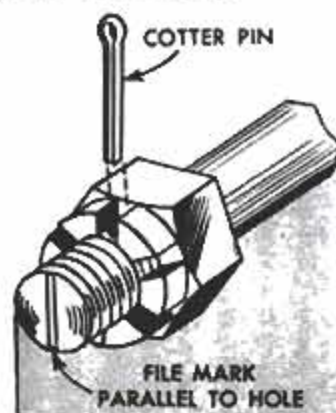
Handy Pen Wiper on Ink Bottle



Artists will find that one or two pipe cleaners wrapped around the neck of an ink bottle provide a pen wiper that is always at hand. Since the cleaners are very inexpensive, they may be discarded when saturated with the dried ink.

Notch Locates Cotter-Pin Hole

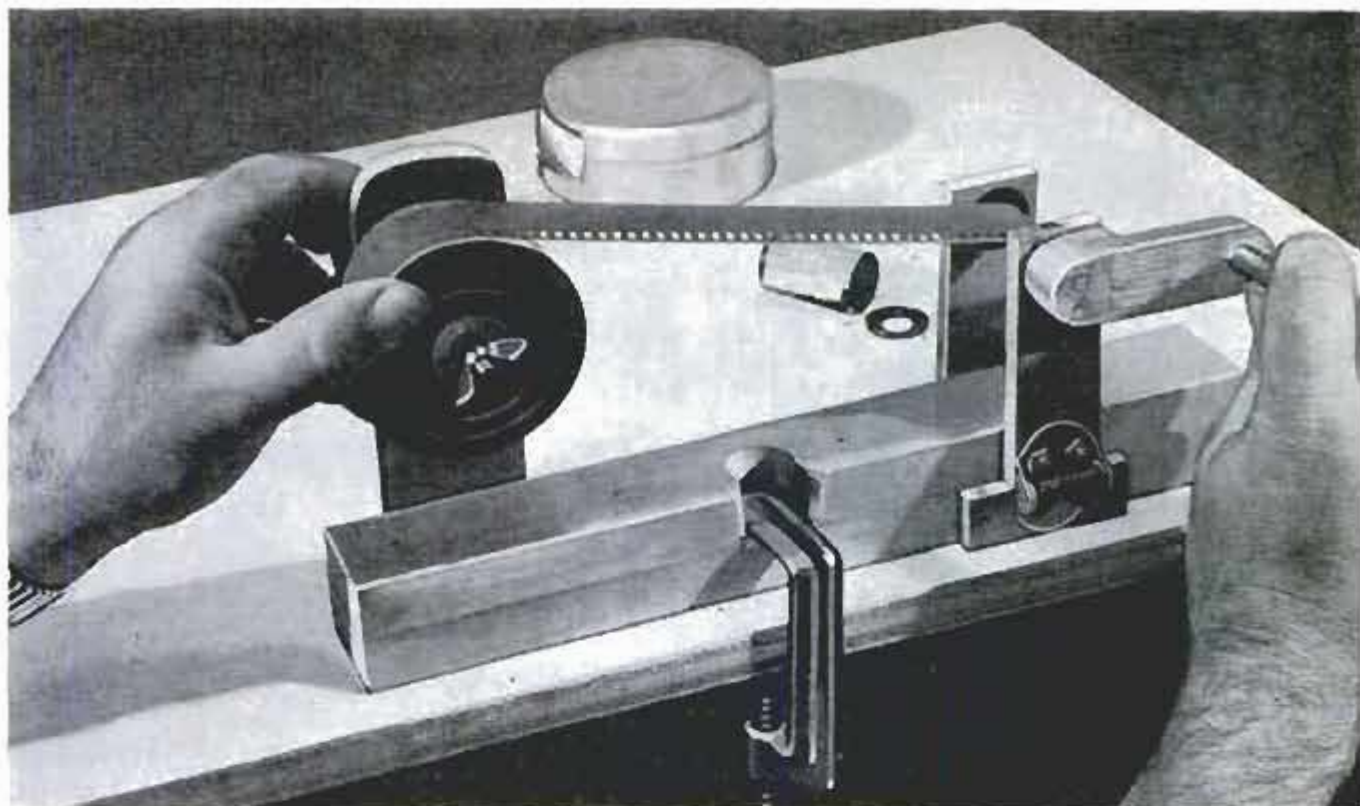
Locating the hole for a cotter pin when using a castellated nut is easy if a guide is provided across the end of the bolt. The guide can be a notch filed parallel with the hole. Then it is just a matter of lining up the nut with the filed indicator notch to insert the cotter pin. This idea is especially handy when working with bolts coated with grease and dirt, or when the bolts are located in places which are difficult to reach.



Nonslip Surface on Erasing Shield

The difficulty of holding an erasing shield in place may be overcome by using drafting tape as indicated. Use two strips on each side of the shield. The tape provides a nonslip surface when pressed against the work.—T. V. Walters, Chicago.



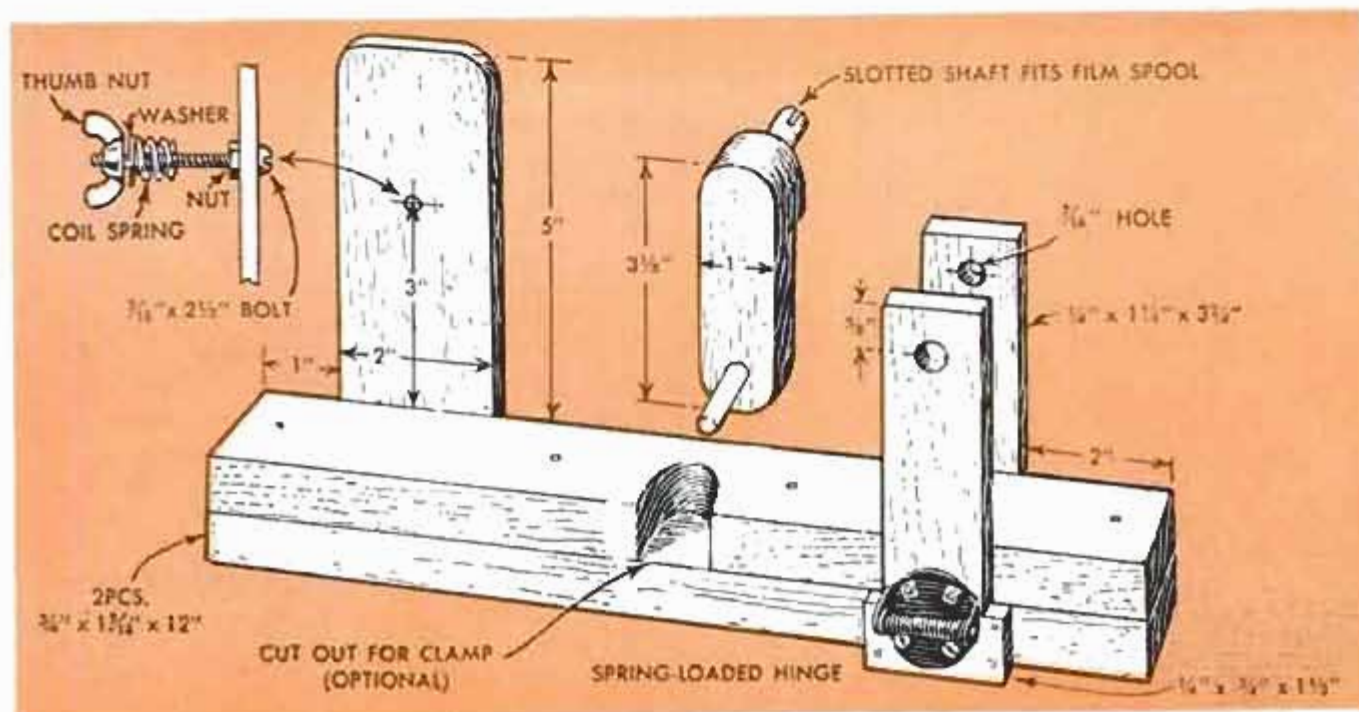


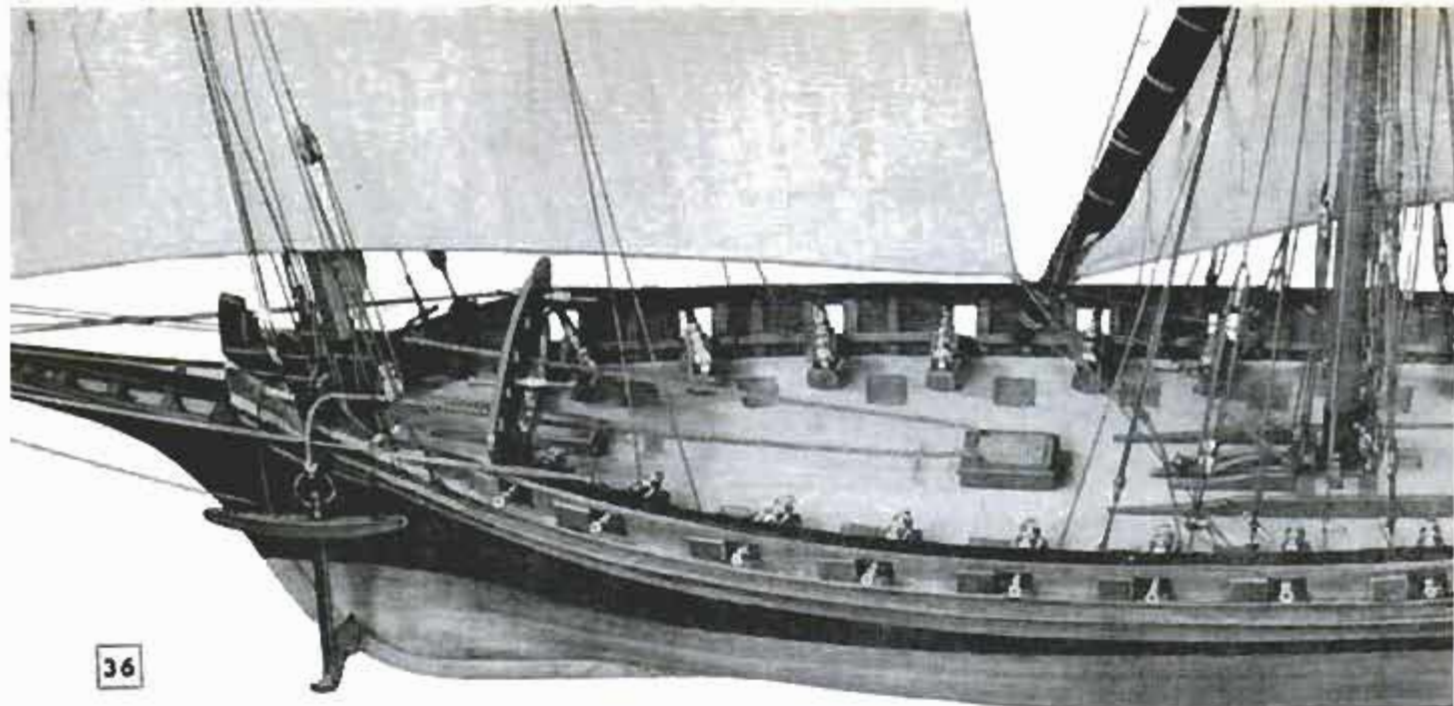
35-MM. BULK-FILM LOADER

By Louis Hochman

DESIGNED for the photographer who shoots 35-mm. film extensively, and buys in bulk to save up to 75 percent of film cost, this jig makes quick work of rewinding the film on 20 or 36-exposure spools. As indicated, the empty spool is fitted between the spring-loaded uprights and the crank is fitted on the end of the spool to permit rotating it. Tension is kept on the roll of bulk film by means of a spring and thumb-screw. The correct tension may require

some experimentation to determine at what setting the film unrolls to provide a properly wound spool for insertion in its cassette. Thirty rotations of the crank on the spool will produce a film length of 5 ft., which is the equivalent of a 36-exposure spool. All rewinding of bulk film is, of course, done in total darkness. This rewinding jig is designed for simplicity of operation in the dark, but it still is necessary to use care to avoid scratching the film or finger marking it. Cellulose tape fastens the end of the film to the empty spool.





MODELING THE FRENCH

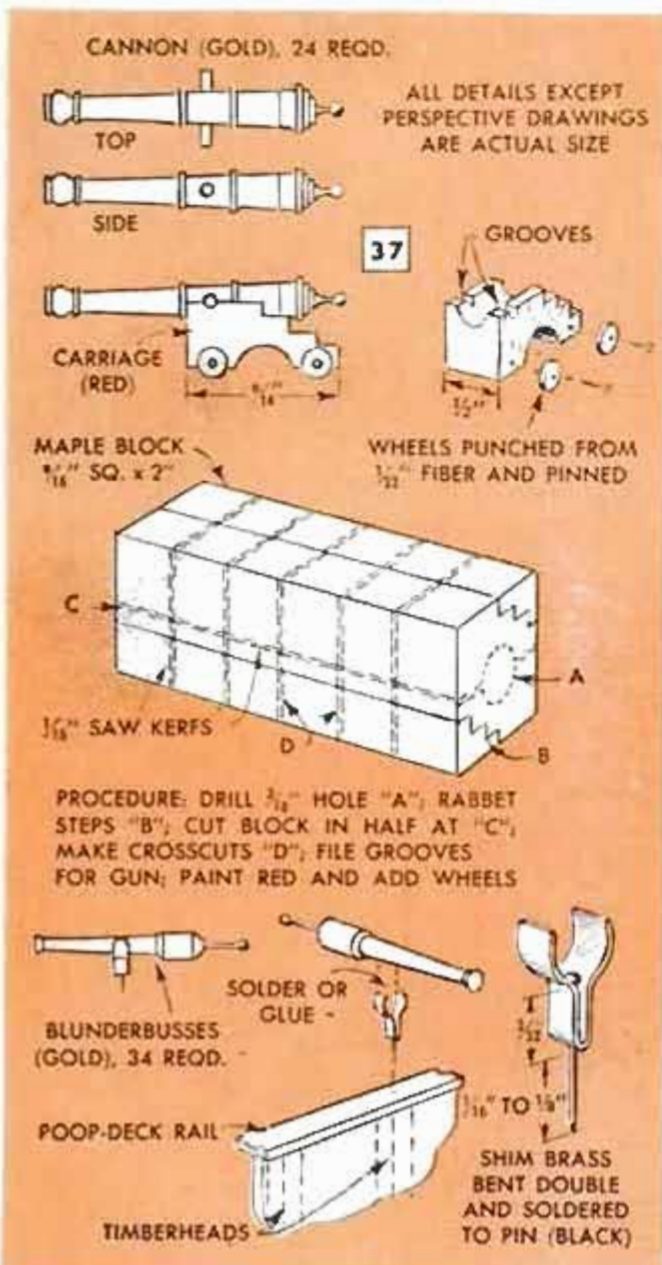
Guns, deck fittings, longboat and masting

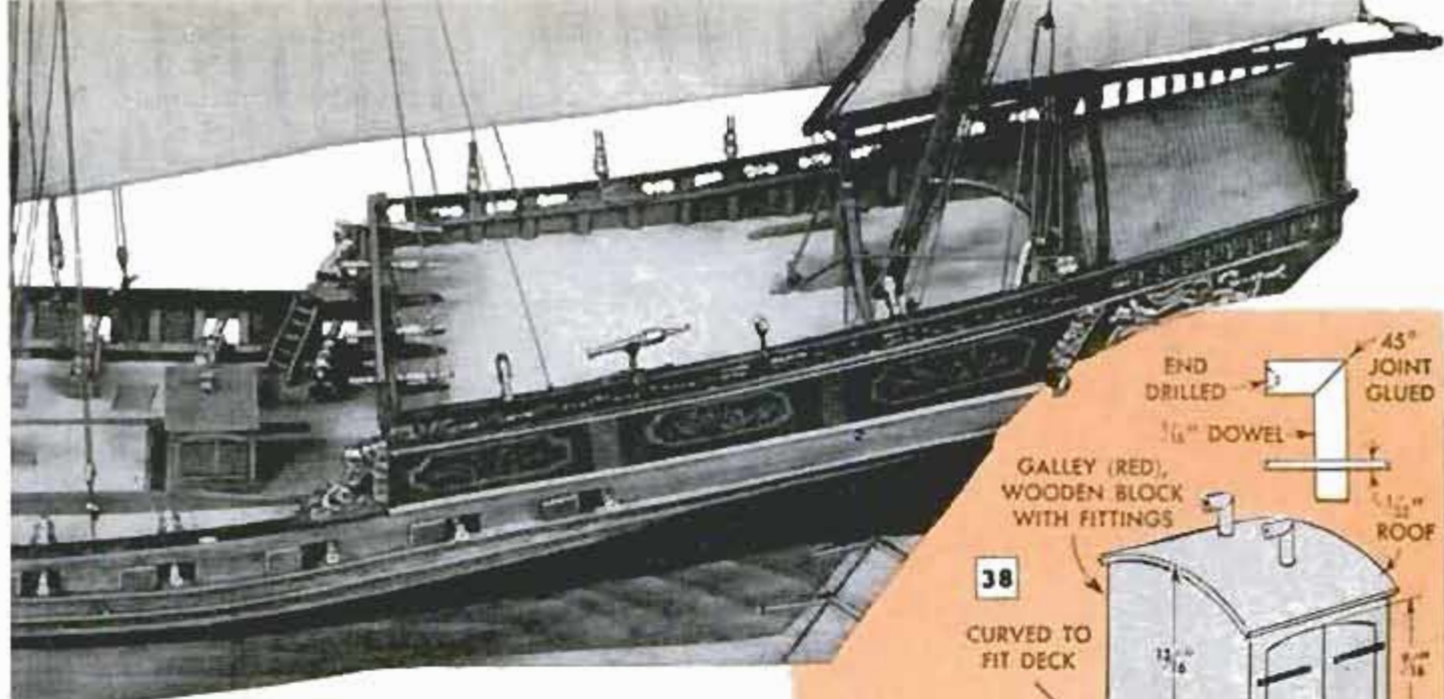
AT THIS STAGE of building your model *Chebec*, which began in the Nov. 1958 issue, you are ready to proceed with the deck fittings and other small equipment as well as the masts and yards. Fig. 36 shows the appearance of the deck with all fittings except the longboat after the model has been completed, including the rigging.

Making the Guns

There are 24 six-pounder cannon positioned on the main deck at locations indicated in Figs. 14 and 42. Details on making them are given in Fig. 37. You may be able to purchase somewhat similar guns already mounted on carriages and thus eliminate considerable work. But if you intend to make them, turn them from either brass or maple, using a cutting tool that you have ground to the gun shape. Drill the guns crosswise for pins that serve as mounting pivots. The gun carriages are grooved to take the pivots and the barrels, and the guns are glued in place. The carriages are pinned to the deck to fit snugly against the bulwarks. It is possible to cut 12 carriages from a single small block of maple by following the procedure outlined in Fig. 37. The carriage wheels are punched from $\frac{1}{16}$ -in. fiber and are pinned in position.

There also are 34 two-pounder blunderbusses; eleven at each side of the poop deck, and six on each breastwork, if you wish to include all of them. Originally the





CHEBEC

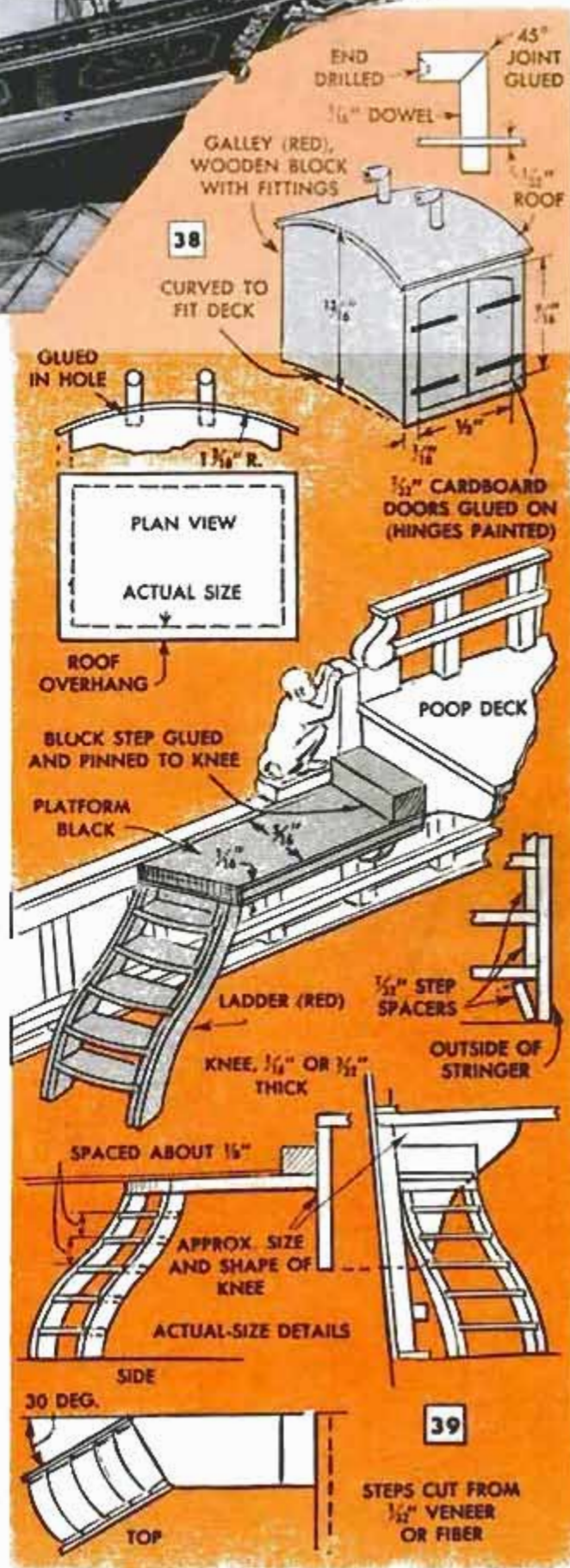
PART III

blunderbusses had universal movement, but those made for the model only swing horizontally since they are soldered or glued to holders also detailed in Fig. 37. You make the holders by doubling tiny strips of shim brass on pins, spreading the ends to the gun diameter, and then soldering the brass and pin together. The pins are cut down to the required lengths later. Those at the sides of the poop deck extend into the ends of the timberheads about $\frac{1}{8}$ in., but those on the breastworks are necessarily shorter. The guns are painted gold to represent brass. The cannon carriages are red and the blunderbus holders are black. It's best to wait with installing the guns on the model until after the rigging has been completed as they are easily broken.

Galley and Ladders

For location of all the deck fittings refer to Fig. 42. You can start on these by making the galley, Fig. 38. This is simply a wood block, the bottom of which is sanded down concave so that it fits the deck properly for gluing. However, if you want to eliminate such shaping, just glue little blocks to the four bottom corners. The roof, which projects equally on all sides, is a piece of $\frac{1}{32}$ -in. veneer glued on. The two doors also are overlays of either cardboard or veneer. The hinges are painted in black over the red galley surface. The smoke pipes of the galley face forward, not aft.

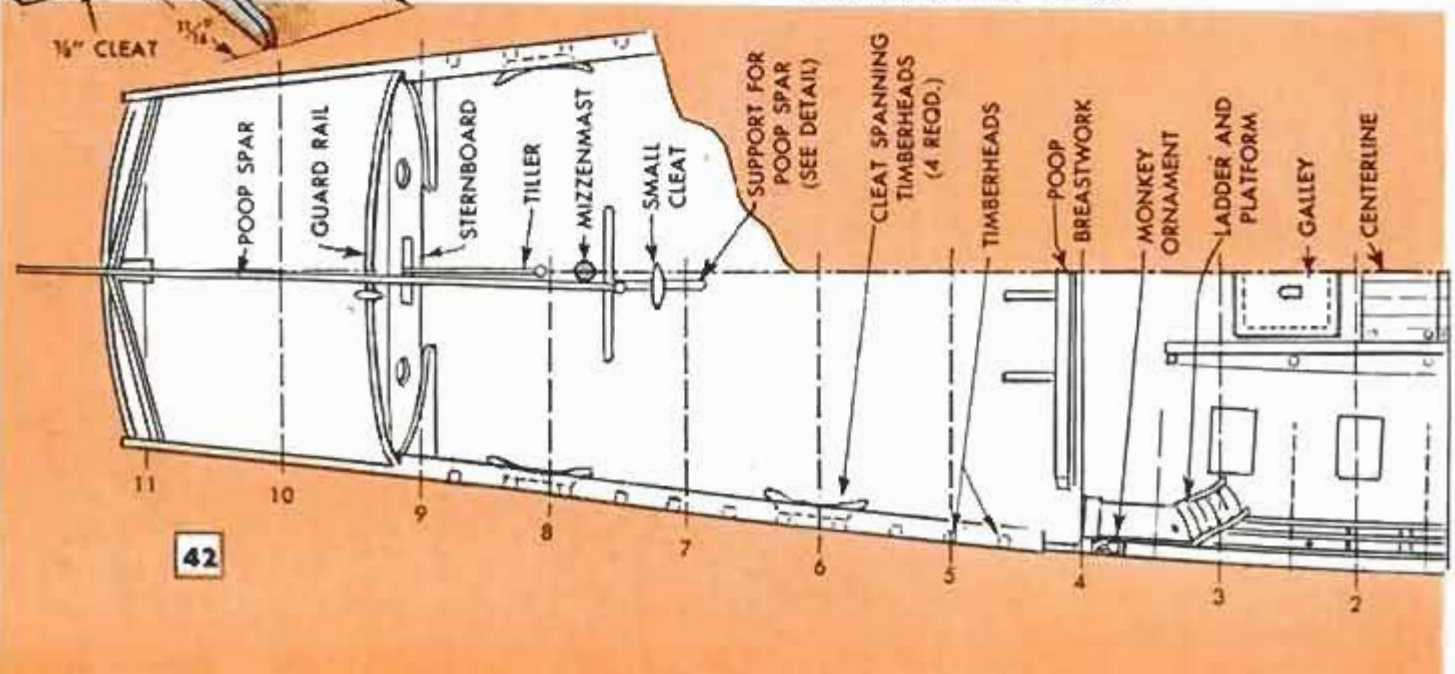
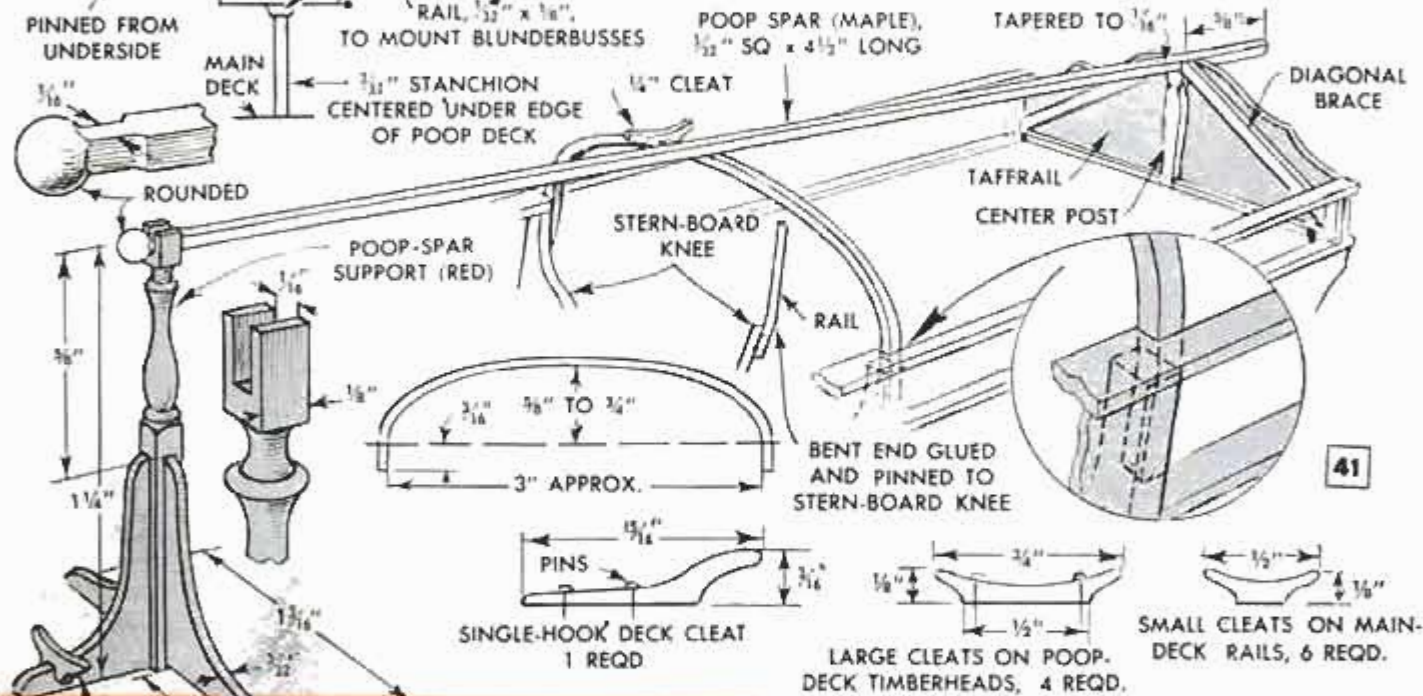
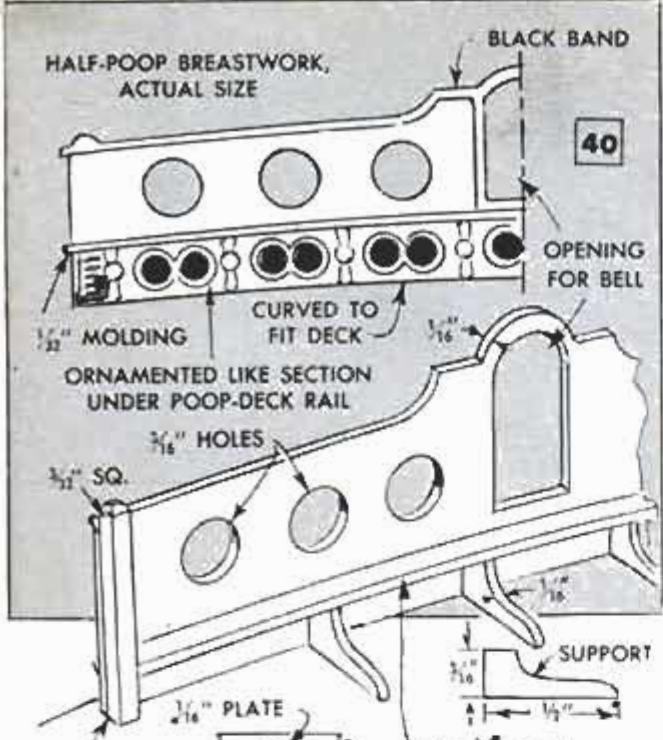
Construction of the two ladders and



platforms that give access to the poop deck is shown in Fig. 39. First install the knees between the poop deck and the two timberheads at station No. 4. Pin the poop deck to the knees besides gluing the contacting edges. Note how the steps are held by means of filler blocks for uniform spacing and strength of assembly when glued together. The ladders are set at an angle to the bulwarks, and come about midway between two guns, near one corner of the grating between them.

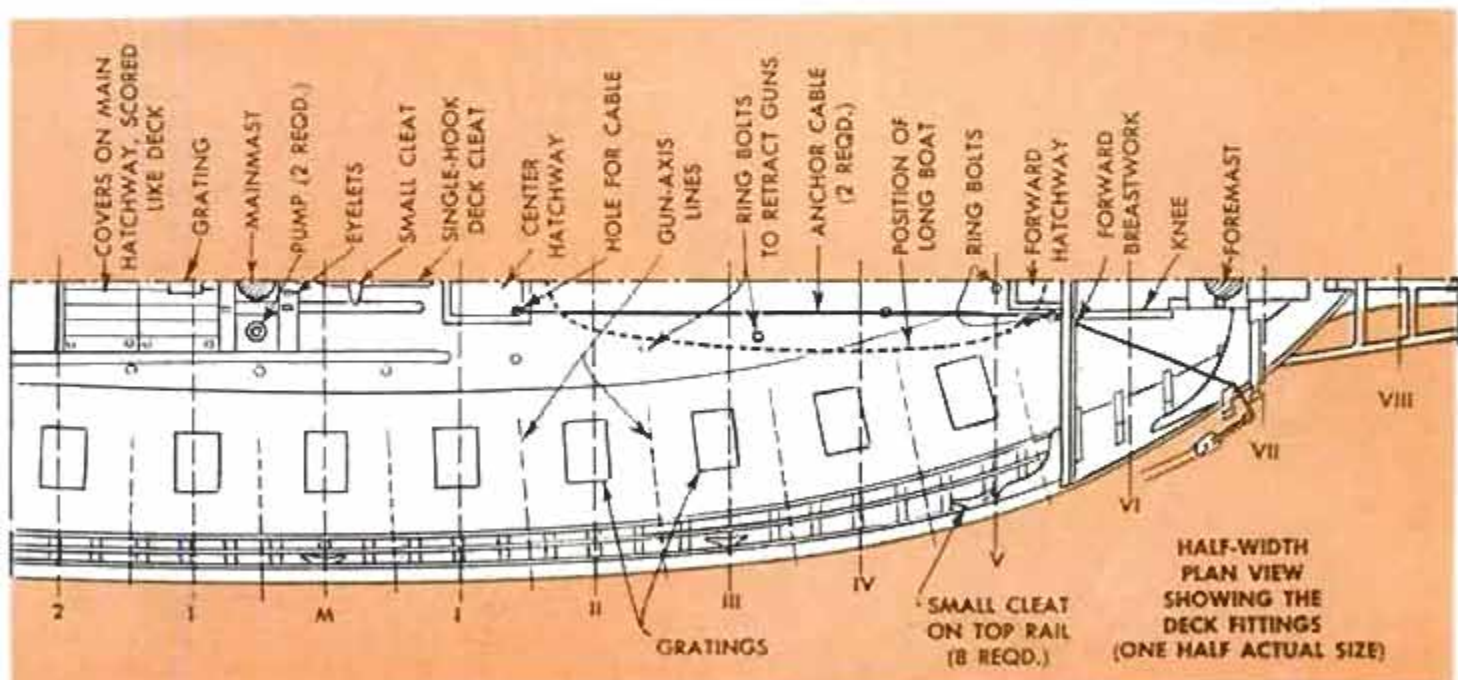
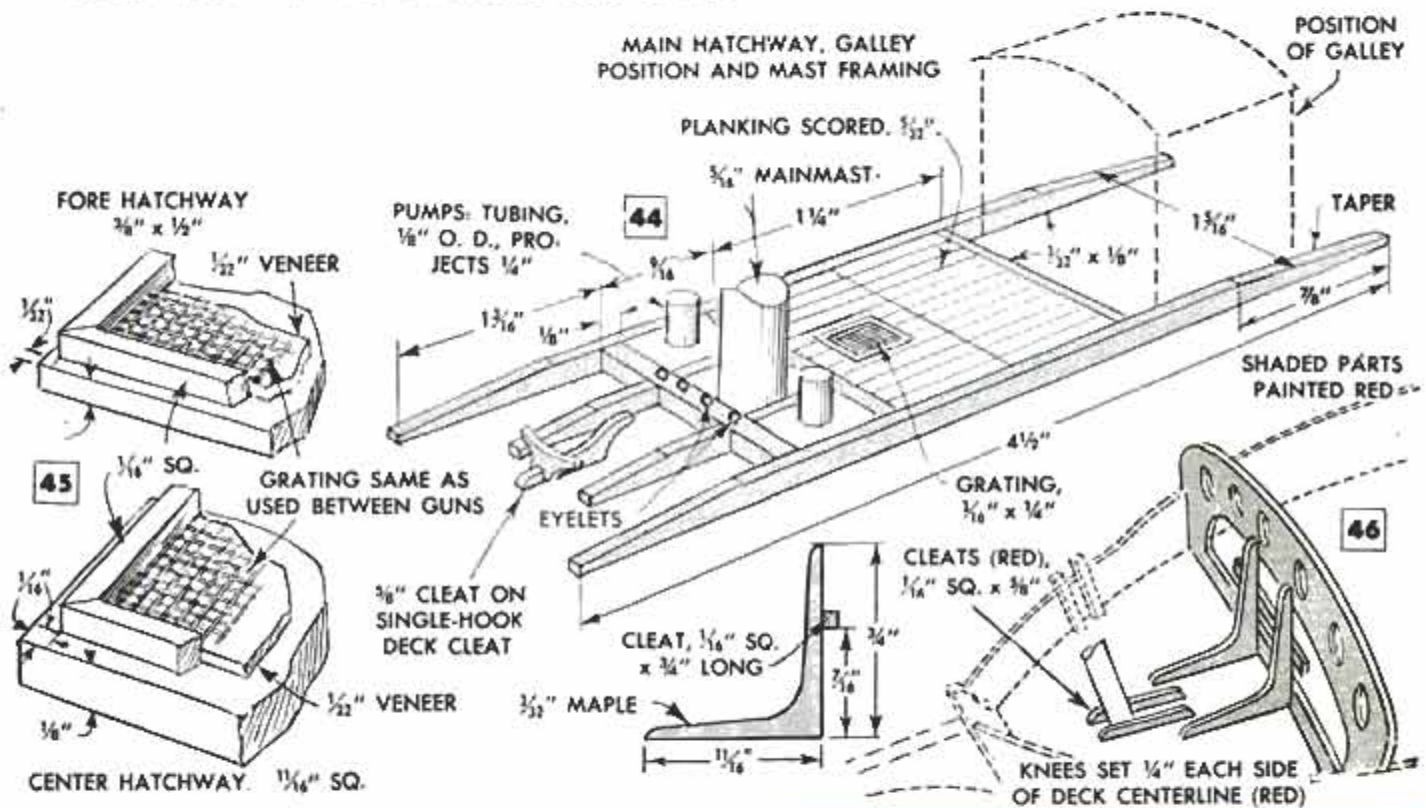
Poop-Deck Fittings

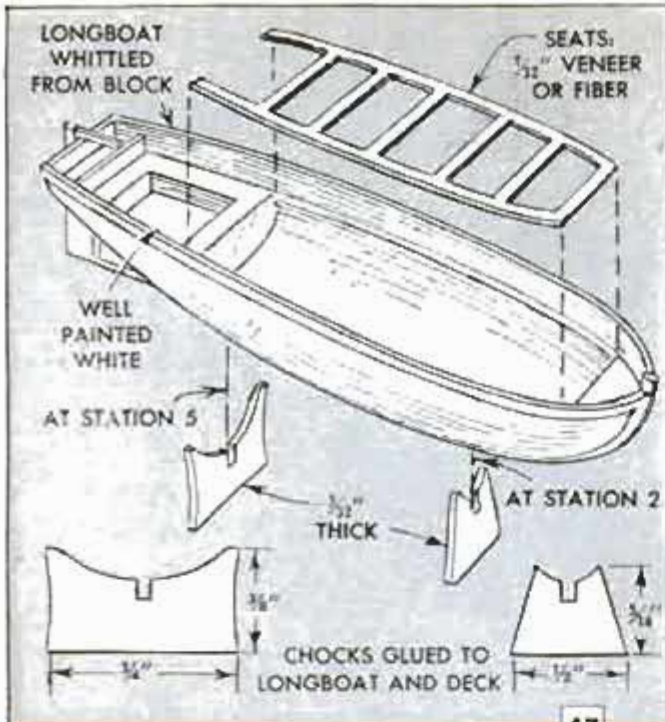
The front view of the poop breastwork is shown actual size but half width in Fig. 40. The end posts may be pinned or have tenons glued in holes in the deck. Note that the horizontal lines of the breastwork are parallel to the crown curvature lines of the poop deck. The center opening is the belfry where the ship's bell was



hung. The poop breastwork is more ornamental than the forward breastwork. The molding along its upper edge can be glued on, produced with gesso, or merely simulated with a band of black paint on the red surface. After the breastwork has been installed, you can fit the single stanchion that supports the edge of the poop deck at its center, also detailed in Fig. 40.

As shown in Figs. 41 and 43, the aft end of the poop spar fits between the two diagonal braces on the taffrail, and rests on the center post. The forward end of the spar is held by a decorative support of which the upper part is turned. The lower part, which is left square, is glued to three knees. These, in turn, are glued to the deck so that the center of the support comes about $\frac{3}{16}$ in. on the starboard side of the



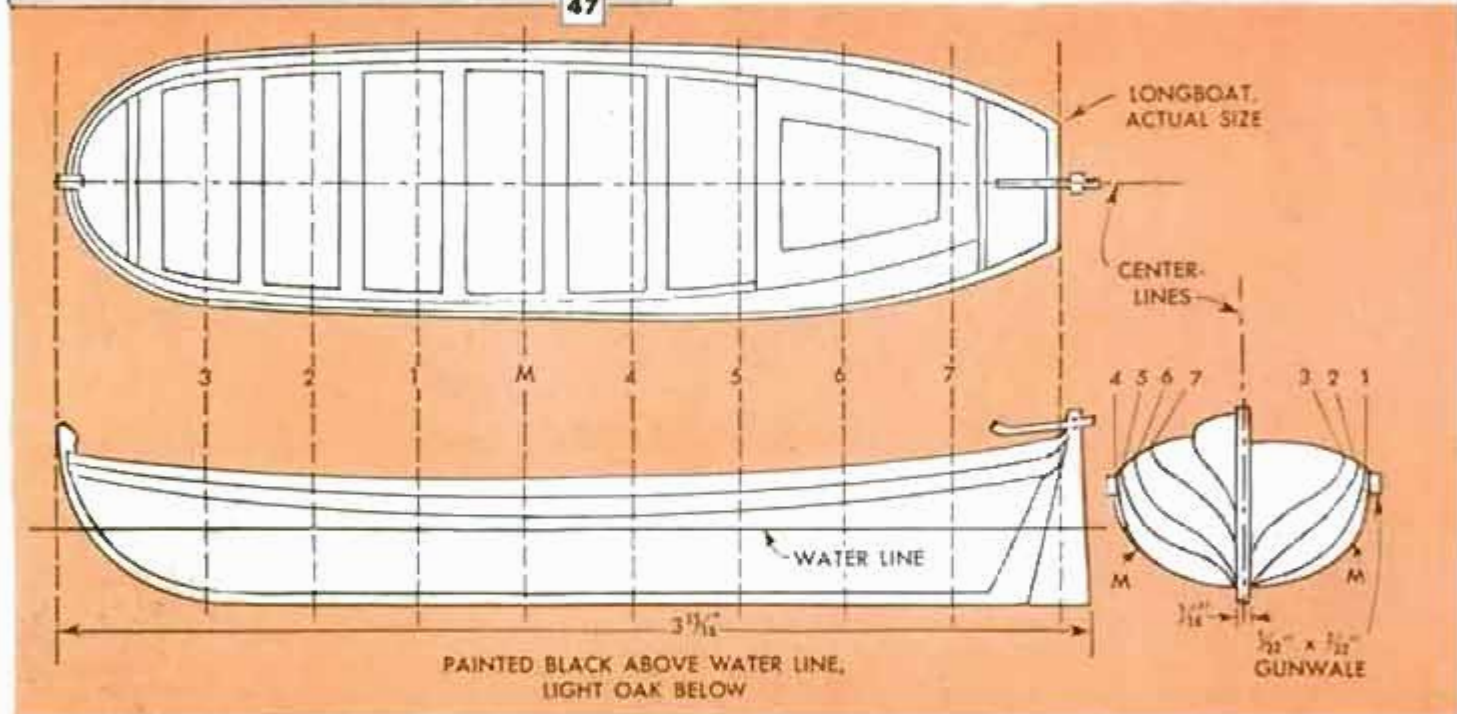


42. One single-hook cleat is located on the main deck just ahead of the mainmast. To it is glued a smaller cleat which is notched to fit. Six 1/2-in. cleats are glued to the main-deck rails for the attachment of rigging lines. Their positions are also indicated in Fig. 42.

Hatchways and Grating

Fig. 44 shows the two-piece main hatchway, which is scored and stained like the deck. The detail includes the two pumps on either side of the mainmast. Tiny wire eyelets at the base of the mainmast, to be used for rigging, are to be installed later. Their size, position and purpose will be detailed in Parts IV and V.

The forward breastwork is provided with two supporting knees connected with a cross cleat as detailed in Fig. 46 which also shows cleats on the deck at either side



hull centerline so it will clear the mizzenmast. A small cleat is notched and fitted to the center knee of the support.

The spar also is supported near its midpoint by a guardrail. Both are pinned and glued together, which gives additional reinforcement to the taffrail. The guardrail may be square copper bus-bar wire, or aluminum rod filed square, both being easy to bend. Or, you can make it from a strip of maple, steam-bending the ends. Note how the ends are pinned and glued to the knees that brace the sternboard, which arrangement also helps to support the poop rail.

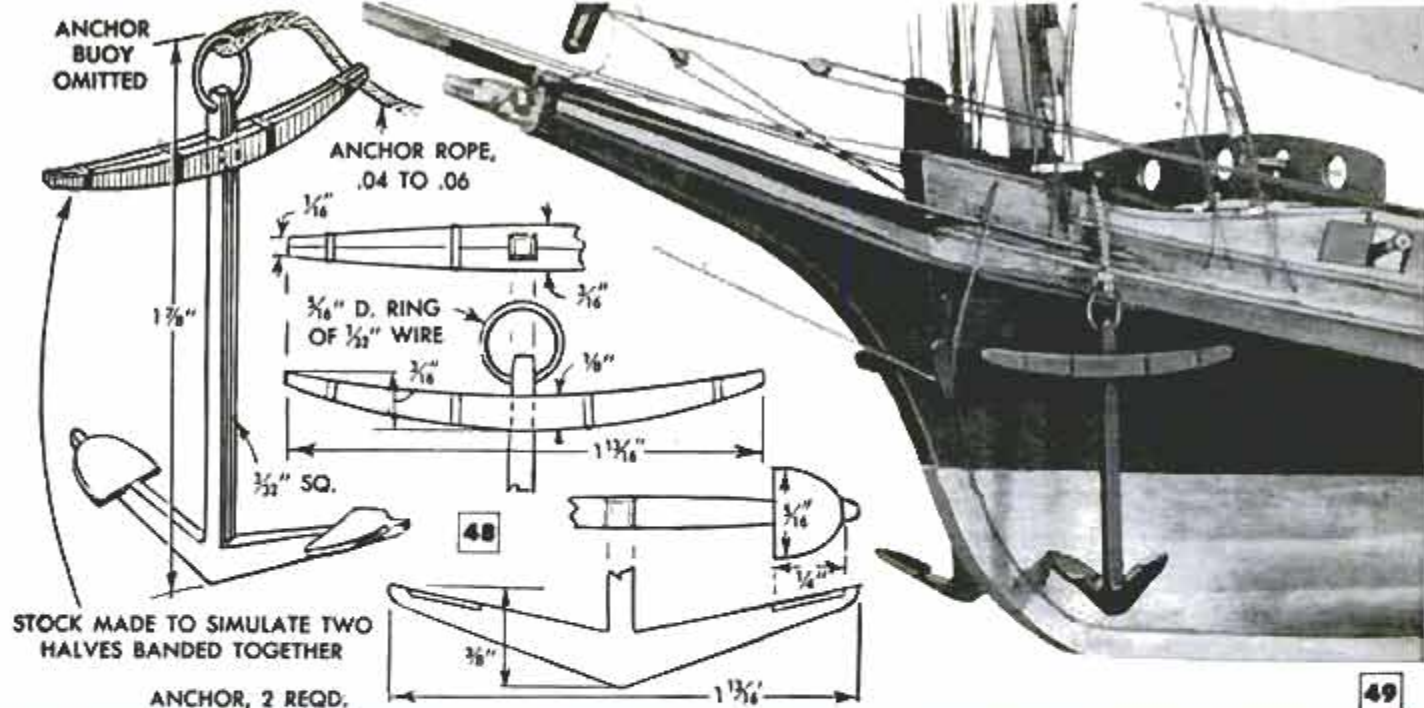
Fig. 41 shows the shape and size of the three kinds of cleats that are used. Four large ones are fastened with glue and pins to the poop-deck timberheads just below the top rails at locations indicated in Fig.

of the foremast. These are easy to glue in place even though the bolster plate and crossrail unit are already installed. The center and fore hatchways are located ahead of the main hatchway. They vary slightly in size and height above the deck as shown in Fig. 45. The grating used on hatchways is the same as that used between the guns as detailed in Part I.

The longboat shown in Fig. 47 can be made accurately with the aid of templates for which station lines and contour lines

PORTFOLIO OF PLANS

Popular Mechanics offers the serious modelmaker plans for building four other famous French ship models, namely *La Sablaise*, a sailboat, *Jeanne D'Arc*, a training cruiser, *Marie Jeanne*, a fishing boat and *Le Terrible*, a light cruiser. For a free descriptive brochure on these plans and their prices, write to Popular Mechanics Co., Dept. 80, 200 E. Ontario, Chicago 11.



	LENGTH ABOVE DECK	ANGLE FROM VERTICAL	D.A. AT DECK	DIA. AT TIP	SIZE OF MASTHEAD BLOCKS
FOREMAST	8-3/8	15 DEG. FORE	1/4	5/32	5/32 SQ. 5/8 LONG
MAINMAST	9-1/2	2 DEG. AFT	5/16	3/16	3/16 SQ. 3/4 LONG
MIZZENMAST	5	7 DEG. AFT	5/32	3/32	3/32 SQ. 3/8 LONG

	LENGTH	A	B	C	D	E	F	G	H	I	J	K
FORESAIL YARD	16-7/8	1/4	3/16	5/32	5/32	1	1-1/2	5/64	1/16	1/8	1/2	4
MAINSAIL YARD	18-1/2	5/16	1/4	3/16	3/16	1	1-7/8	3/32	3/32	3/16	1/2	4
MIZZEN YARD	8-3/16	5/32	1/8	3/32	3/32	7/8	1-1/2	1/16	1/16	1/8	3/8	3

are given. The boat can be whittled to shape, hollowing out the inside so a piece of veneer or fiber cut to represent seats can be glued in place. The two chocks that support the boat are notched to take the keel and are shaped to fit the hull contour near stations 2 and 5. They are glued to the longboat hull and also to the main deck of the ship at the location indicated in Fig. 42. Except for the well of the longboat,

which is painted white, the rest of the interior is red. The outside is black above the water line and light oak below. It is possible that you can purchase a longboat of approximately correct size from a model-supply house and thus eliminate the work of making one, even though the details vary a little.

Figs. 48 and 49 show the shape and size of the two anchors. These can be purchased

ready-made. If you do make them of wood, use maple. Drill a hole through the stock to take the tapered end of a $\frac{1}{8}$ -in. dowel, which you sand or file square after gluing it in place. The lower end of the shank is whittled down to form a tenon that is glued in the piece that forms the flukes. Fig. 42 shows the location of the anchor cable, one end being glued in a hole drilled in the corner of the center hatch.

Bowsprit, Masts and Yards

Being slender and fragile, the bowsprit detailed in Fig. 52 is installed after all the deck fittings have been placed. Besides glue, pins are used to secure the bowsprit to the headrail and stem. It also is lashed to the stem just behind the figurehead. Use the same kind and size of thread as for the yard woodings given in Fig. 52. A detail shows how the free ends of the thread are self-held. An added spot of glue helps to prevent loosening. One end of the bowsprit lashing is left extending for attachment of a rigging block.

The lateen sails are the distinguishing features of the xebecs, and are held by yards arranged diagonally as seen in Fig. 3. Details of the masts are given in Fig. 51. Their length includes square masthead blocks which are formed when tapering. The blocks are drilled and grooved as indicated in Fig. 50 to represent sheaves for some of the running rigging. As shown in Fig. 52, the yards are made by sanding two flats on dowels of proper size, then cutting the ends and scoring grooves so that each yard looks like two pieces lashed together with woodings. Note how the ends are cut so that the rounded end of one member seems to fit into a groove in the adjacent member, which keeps them in alignment and provides both strength and flexibility. The letters in Fig. 52 indicate the size of the parts, spacing of woodings, number of turns, as given for the three masts in Fig. 53. It's best to paint the yards black before applying the woodings.

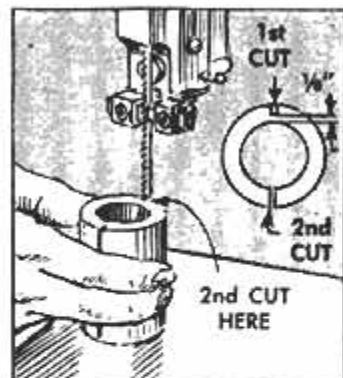
(Continued next month)

Unburned Gas Pollutes Air

According to Champion Spark Plug Co., about half the cars on the road have one or more spark plugs misfiring. This means a tremendous waste of fuel and power. But it also means a lethal dose of air-polluting gas is being pumped into the air we breathe. Automobile mechanics can do much to correct this condition by servicing the spark plugs and air cleaner regularly and by keeping carburetors properly adjusted.

Three-Stage Cut Prevents Binding When Bandsawing Bushings

To prevent binding of the blade when bandsawing bushings or collars, one machinist runs a first and second cut, the first cut running only halfway through the wall thickness of the bushing. Then he turns the bushing 180 deg.

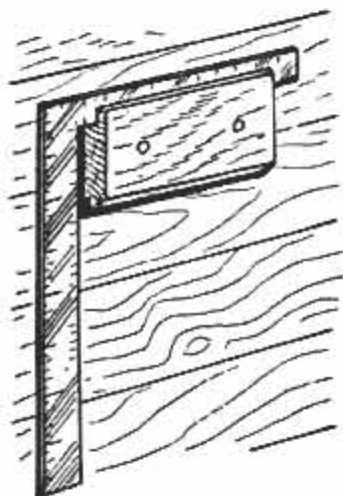


and runs the second cut all the way through, finishing the first cut from the inside. This prevents any tendency of the cut to close up.

Frank LaSaracino, New York City.

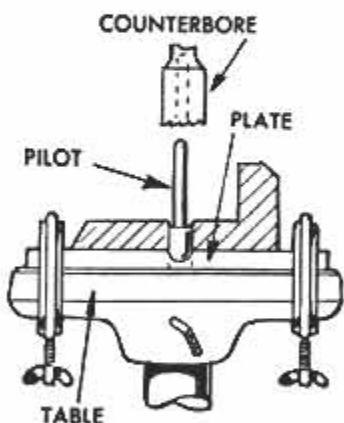
Holder for Steel Square

Although a nail or hook usually is driven into the shop wall to store a steel square, a short strip of flooring nailed in place horizontally will make a much neater and even more secure support. The square drops easily into the groove of the flooring strip.



Protecting Hole Finish

You can prevent possible scoring of the hole finish when counterboring by using a fixed pilot made to suit the job at hand. Remove the regular pilot from the counterbore and fit the big end of the pilot into a reamed hole in a piece of flat steel which is placed under the work in the set-up. Then place the work over the pilot spindle and center it. Finally, bring the counterbore down to the required depth. The pilot should be a light press fit in the hole.



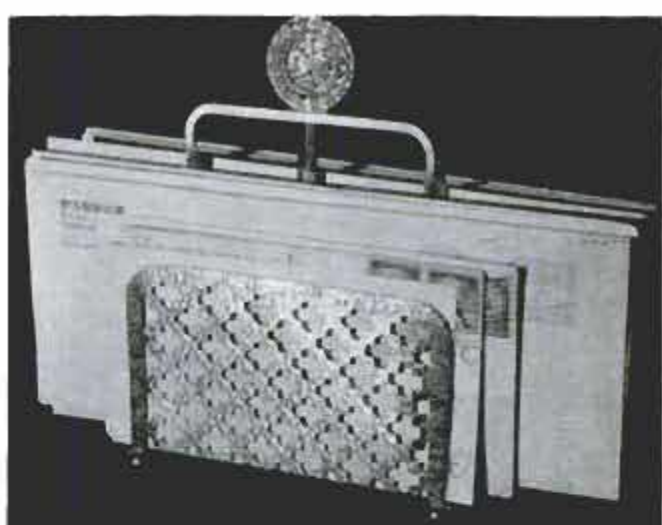
The pilot should be a light press fit in the hole.

ALUMINUM LETTER CADDY

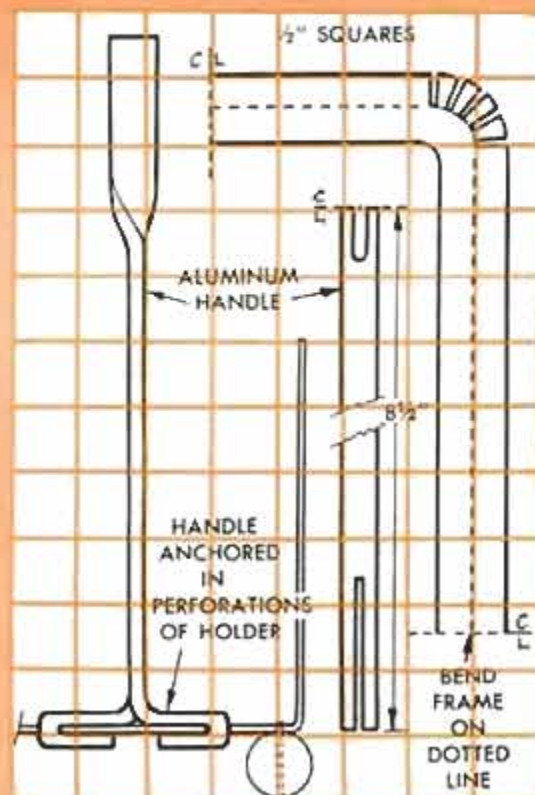
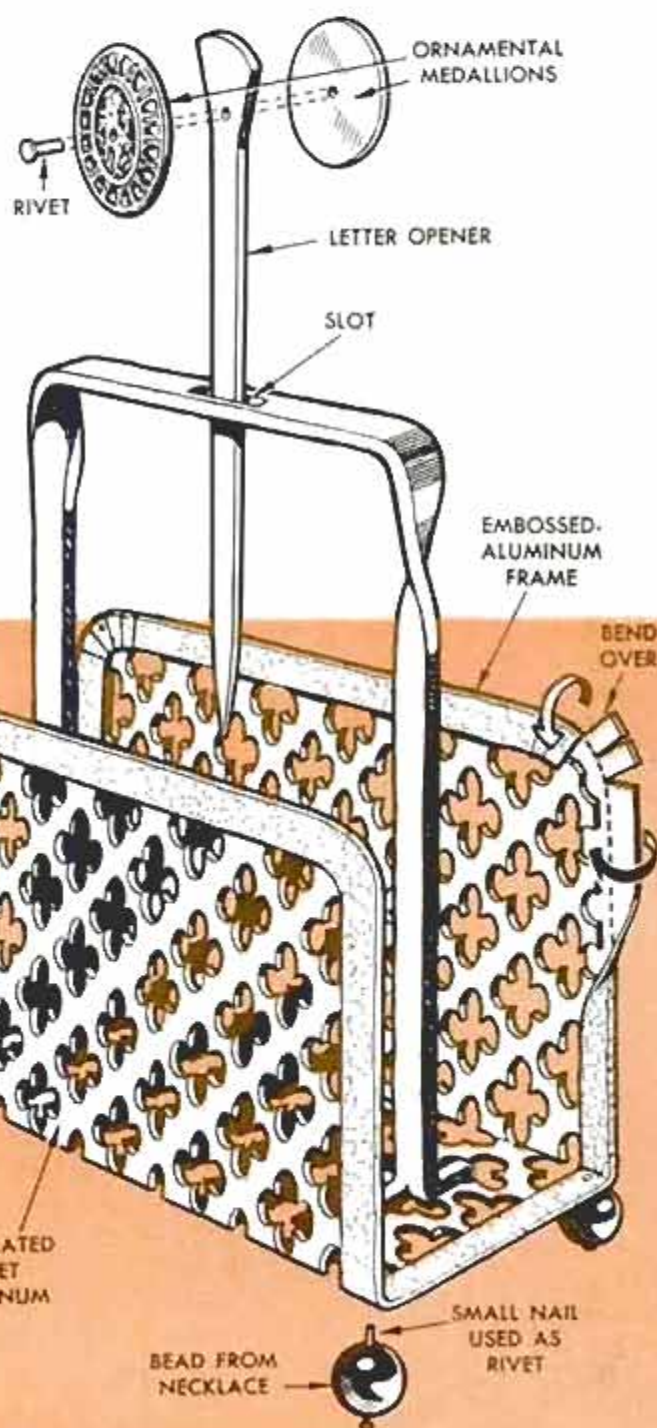
By Bertram Brownold

LETTERS AND BILLS that are to receive your attention or be placed in a file, will not be neglected or misplaced if they are kept in a correspondence holder like the one illustrated. This is a one-evening project requiring a minimum of experience with hand tools. All parts of the holder, except the letter opener and beads used for the feet, are made of aluminum bar and sheet stock that is available at large hardware and department stores.

To make a holder, cut the perforated aluminum to size as indicated in the squared pattern. Then from a sheet of embossed aluminum, make the cutout for the frame, position the perforated piece on it as indicated by the dotted line and bend it over on the edges of the perforated piece, after which the frame is hammered flat. The corners of the frame must be cut as shown to permit the metal to be properly crimped in those areas. The handle is cut and formed from $\frac{1}{8}$ -in. stock as shown and should be fastened to the bottom of the holder before bending the sides into position. The feet are riveted to the corners with small cut-down nails as in the drawing. Ornamental medallions are riveted to the handle of a plain letter opener to complete the job.



Above, handle is located in center of correspondence holder so that unread mail can be placed on one side, unanswered letters and unpaid bills on other side



Multipurpose ORTHOPEDIC WALKER

Designed by F. H. Overman



HERE is an easily constructed orthopedic walker that is designed to help restore the use of muscles of the lower body of a child who is recovering from polio, or is a cerebral palsy or muscular dystrophy victim, by helping him exercise with little or no assistance. Used at the University of Illinois Division of Services for Crippled Children, the walker consists of a base unit of welded-steel tubing and four accessories, the shoulder support, bar support, foot separator and handle bar. The former three are adjustable vertically so that they can be raised as the child grows, providing proper support at all times.

The shoulder support is designed to completely enclose the trunk of the body to provide maximum support and stability in the beginning stages of rehabilitation. The dimensions given in the drawing and details A and B are suitable for a child of four or five of average size and can be changed as required. Padded edges protect the child from bruises and provide comfortable underarm support. The bar support is used in place of the shoulder support after the child has partially re-

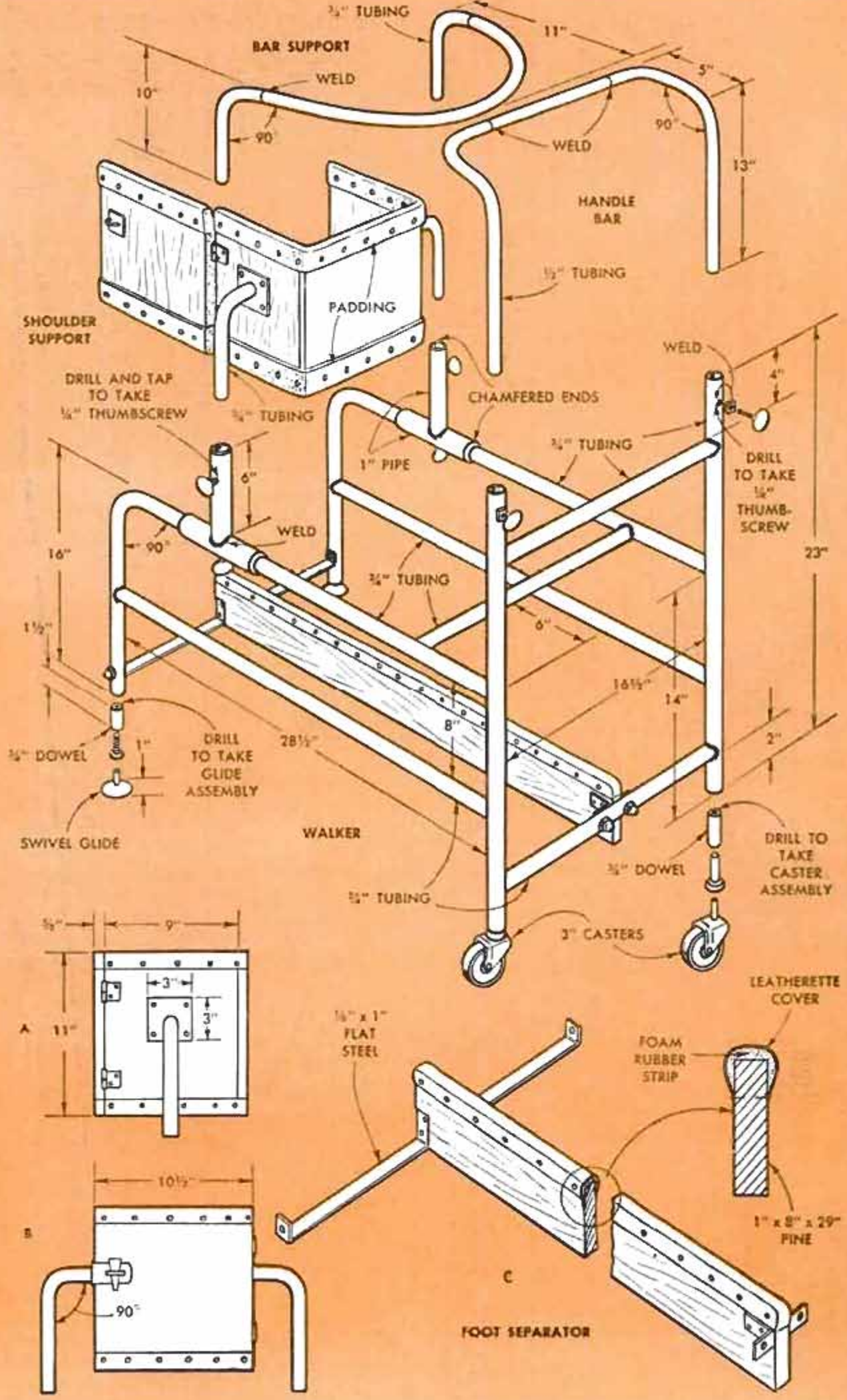
gained the use of leg muscles and requires more freedom for further development. When first making the change-over, a strap should be secured between the two verticals of the support as shown in the illustration on this page, to give the child a feeling of security and to provide some means of support in case of accidental loss of balance. Thumbscrews on the T-members that take the verticals of the shoulder and bar supports permit horizontal as well as vertical positioning of these members for maximum comfort as shown in the drawing and details.

The foot separator is used for a child whose legs tend to cross. It is made of 1 x 8-in. pine,

with steel brackets screwed to both ends of it for bolting the device to the walker as shown in the drawing and detail C. A strip of foam rubber folded over the upper edge of the separator protects the child's legs from bruises. The rubber is held in place by a strip of leatherette fitted over it and tacked to the sides of the separator.

To permit the patient to move the walker across a smooth floor with ease yet require some exertion to develop muscles, the front legs are mounted on 3-in. casters and the rear ones are fitted with swivel glides. These are installed in the open ends of the tubing by first gluing a short length of dowel in each of the legs. Then the dowels are drilled to take the glide and caster assemblies as indicated in the details.

Use a $\frac{3}{4}$ -in. thin-wall-conduit bender for making the right-angle bends in the tubing as required in each of the assemblies. If a welder is not available, take the assemblies to a welding shop to have this work done. Added wall thickness to the conduit is provided for the thumbscrews by welding nuts over holes in the pipe. Nuts are not needed for the 1-in. pipe. ★ ★ ★



Balanced Suspension Keeps Scale Handy for Weighing Milk



When keeping a record of the milk produced by each cow in your herd, the scale used for weighing the milk can be kept conveniently at hand by suspending it from the ceiling of the dairy barn by means of a counterbalanced rope-and-pulley arrangement similar to the one shown at left. When not in use, the counterweight automatically pulls the scale up to the ceiling where it remains out of the way until needed again. The counterweight used should be only slightly heavier than the scale, so that the latter gently rises to the ceiling without impact of a force that may affect the accuracy of the scale.

New engine pistons that are to be installed as a set should be carefully weighed on an accurate scale to check on excessive weight variation. If there is more than $\frac{1}{2}$ -oz. difference between the heaviest and lightest pistons, objectionable engine roughness will result. Such pistons should be returned and exchanged for a set that is within acceptable weight tolerances.

Harvey Muller, Danboro, Pa.

Ignition Trouble From Oil Vapor

Not infrequently, auto-ignition trouble is the result of vaporized crankcase oil condensing on the breaker plate of the distributor which induces arcing and rapid burning of the points. This may occur when the distributor shaft is worn, allowing vaporized oil to travel from the crankcase to the distributor, or it may occur when the cap on the oil-filler pipe is clogged, restricting passage of air. A clogged cap is easily cleaned with gasoline but a defective distributor shaft requires replacement of the shaft or bushings to correct this trouble. The latter should be done by an experienced mechanic.

M. Robert Beasley, Jackson, Mich.

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Reversed Tip on Soldering Iron Produces Better Joint on Flat Work



If your electric soldering iron has a removable copper tip that is of the same diameter throughout its length, try reversing it the next time you have a soldering job that requires joining one or more flat surfaces, such as enclosing the end of a tube as shown in the photo at left. The flat end and cylindrical sides of the reversed tip permit better contact with the surfaces of the joint to make the melted solder flow evenly. It is difficult to avoid forming irregular and poorly bonded metal when soldering such a joint with the pointed end.

Ken Murray, Colon, Mich.

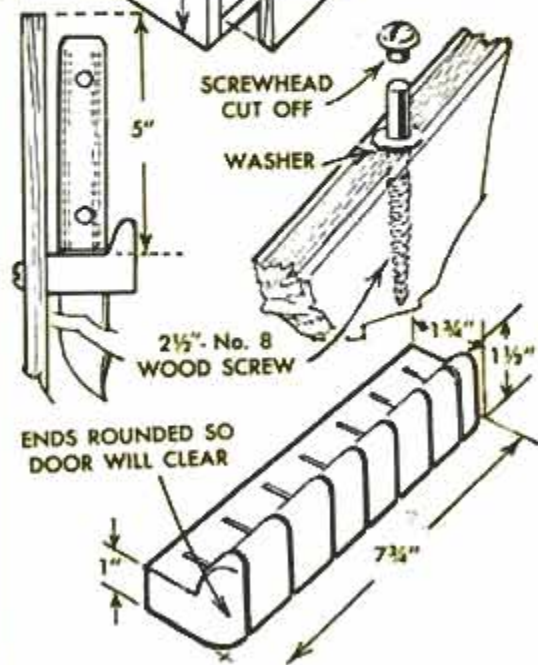
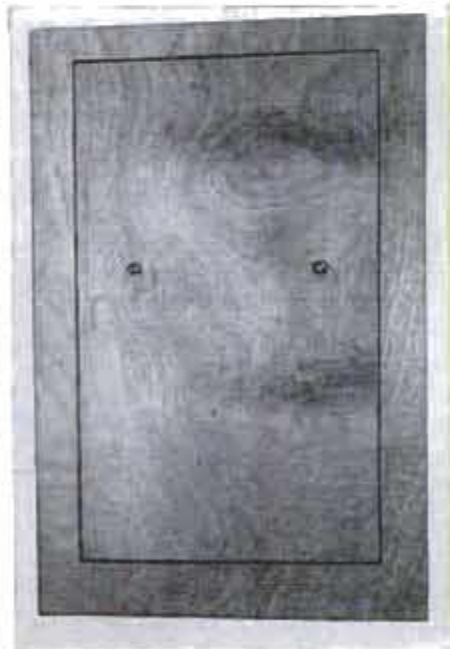
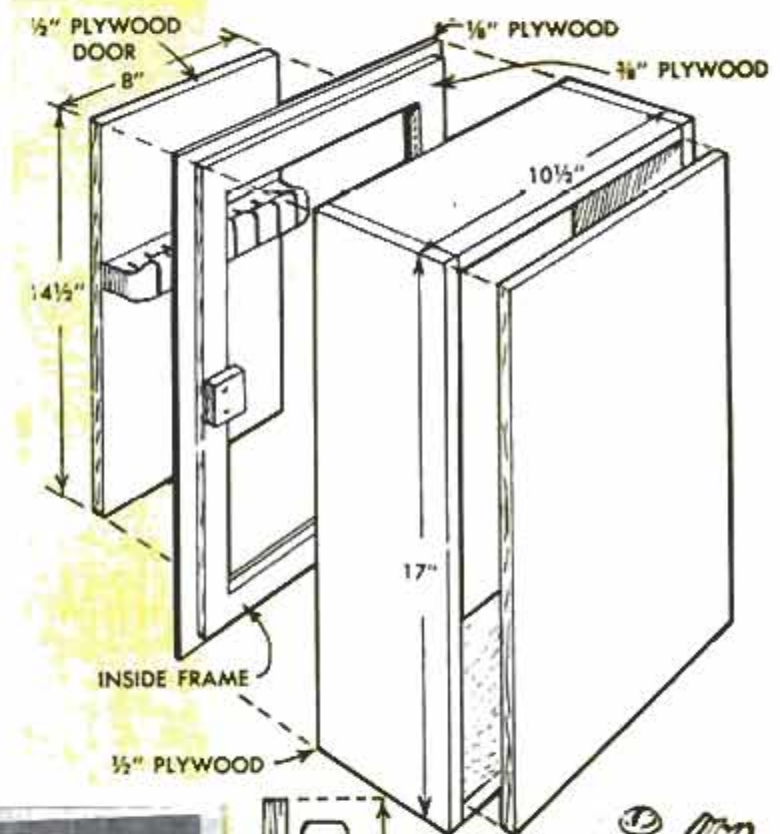
Keep Your Knives In a Wall Cabinet

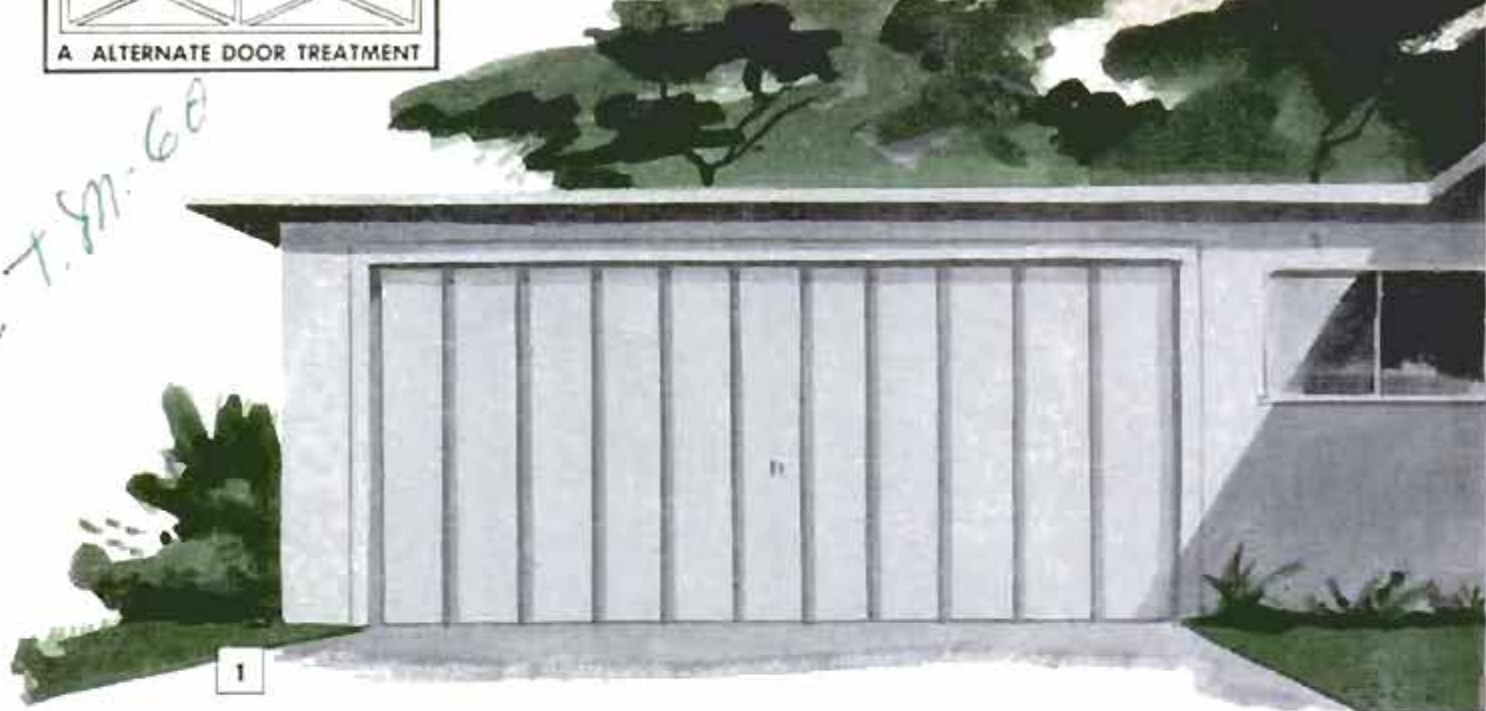
By Stanley Roberts

THERE'S NO BETTER PLACE for household carving knives than a dustfree wall cabinet conveniently located, but out of reach of small fry as shown in the illustration. The cabinet may be flush mounted in a wall, or screwed to an existing cabinet or wall as desired. For a flush mounting, the front of the cabinet should overlap the sides, top and bottom by at least $\frac{1}{4}$ in. to conceal the edges of the cutout that is to receive it. Fir or hardwood plywood may be used for all parts of the cabinet, except the slotted knife rack which is made of solid stock and screwed to the inside of the door as shown in the two details at the bottom of the drawing. The dimensions given are intended to serve only as a guide and may be enlarged to accommodate more pieces of cutlery, or they can be reduced to fit a smaller space.

The door pivots on pins made from screws. To install these, tightly wedge the door into position in the frame and drill holes through the top and bottom of the inside frame to take the shanks of $2\frac{1}{2}$ -in. No. 8 screws. Then drill pilot holes in the upper and lower edges of the door, drive the screws into position and cut off the heads. A washer placed on the lower pivot when the screw is driven, serves as a spacer and bearing as indicated in the detail.

Below left, completed fir-plywood cabinet is ready to be painted and screwed to kitchen wall. Below right, birch plywood is used for door and front of cabinet that is to be varnished and mounted flush





Whether you use it to hide a joint, to create a high or low-room effect or to take away that homemade look from your shop-built furniture projects, you'll find that

MOLDING MAKES THE

AS MOST EVERYONE knows, a piece of molding is just the thing for covering up an ill-fitting joint. But that's far from all it can do. Each of the hundreds of different moldings that you will find in a well-stocked lumberyard was made to do a certain job. Add a touch of ingenuity and they will do more in the way of smart cabinet-door handles, facings for plywood edges, unique picture frames and so on. In addition, moldings can be used to add

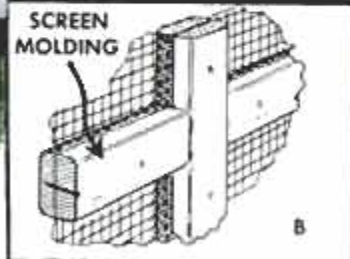
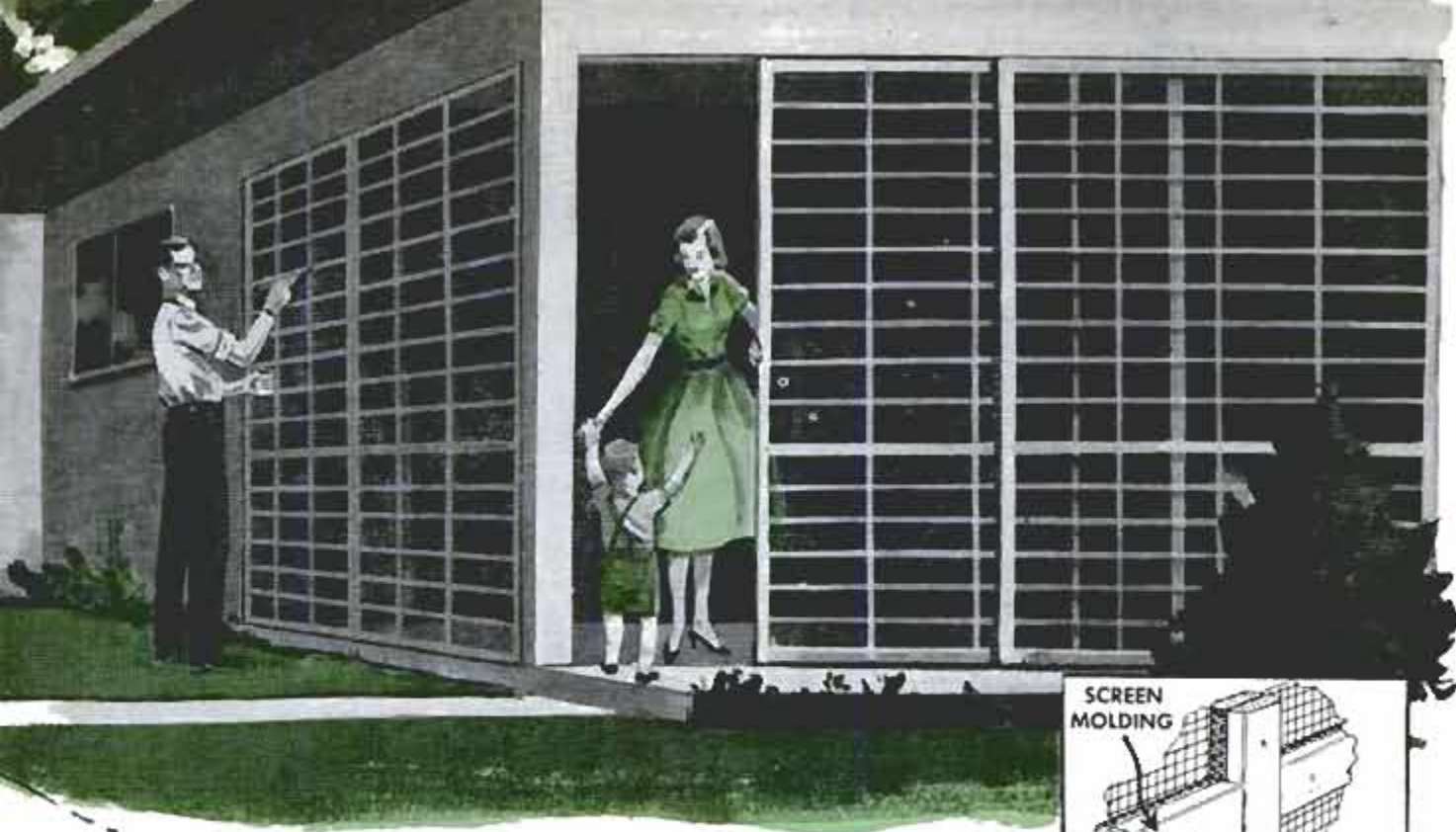
height, or lowness, to separate surface planes and to create textural effects. The effect—the decor—can be either traditional or contemporary.

Shapes Standardized

Most moldings are of softwood, with the lion's share coming from pines, firs, redwoods, spruces and cedars of the Western states. In the past, many mills made fairly similar "standard" patterns, but pieces



High-level look to modern rooms with low ceilings is created by applying nested rectangles of half-round molding to the ceiling. This stunt also affords chance to put more color into a ceiling without losing the unity that the plane provides a room



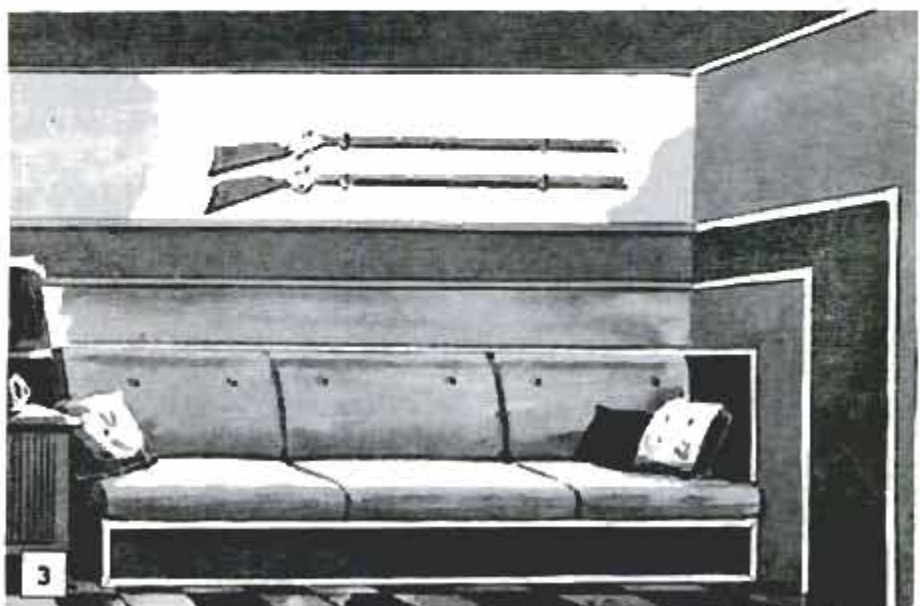
DIFFERENCE

By Tom Riley

seldom matched exactly unless they all came from the same stack. However, in 1957 the Western Pine and West Coast Lumberman's associations joined in establishing exact sizes and shapes for more than 500 standard patterns of molding, and the mills in the West and many others have replaced their molding knives to conform with those standards. Today, you'll find that most of the moldings obtained at different times or places will match.

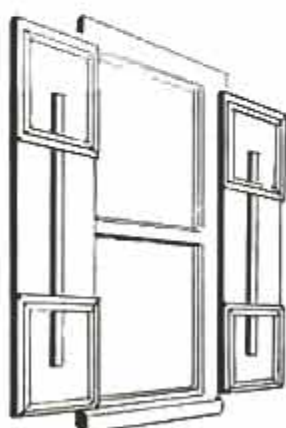
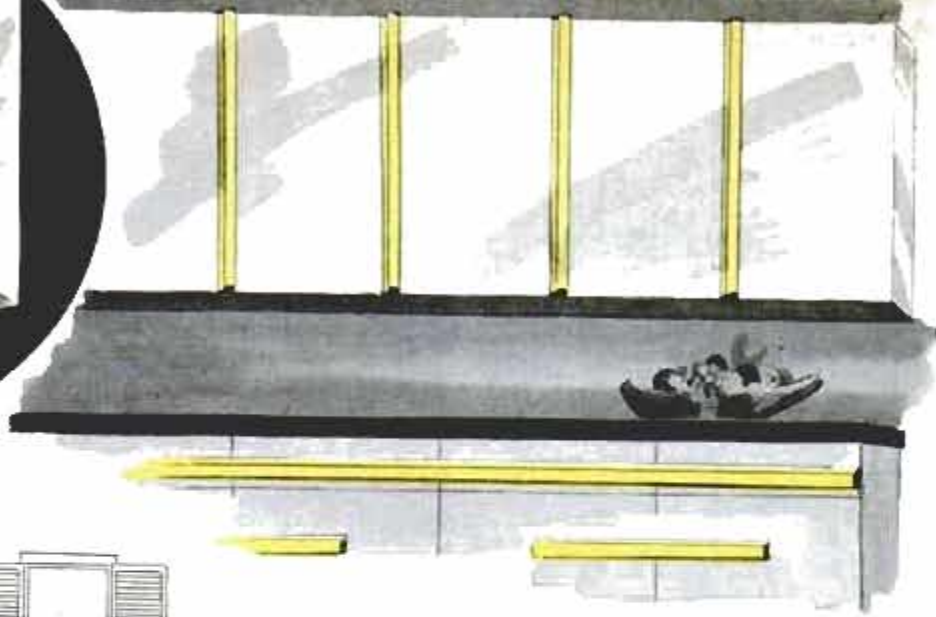
The names given to some standard moldings are confusing. Crown, bed and cove moldings, Fig. 8, are similar, mechanically, and in the larger sizes, are used primarily for wall-to-ceiling joints. Bases are baseboards. Base shoes are designed to cover the joint between the baseboard and the floor. They come in varied patterns and can replace ordinary quarter-round for many other usages. Picture moldings are not for picture frames (though many will

Long, low lines are stressed in this interesting use of molding which emphasizes length and lowness to a built-in sofa. Note, too, how molding ties planes and surfaces together. Permits areas between molding to be decorated in harmonizing colors



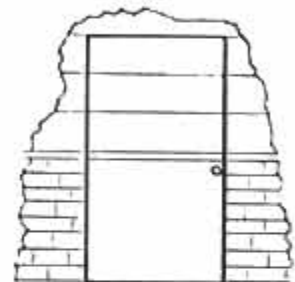
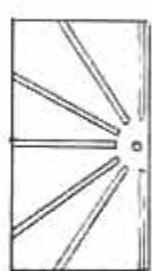
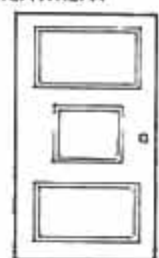
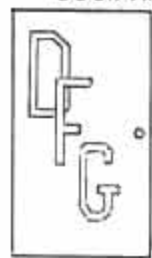


4 CABINET AND DRAWER HANDLES



5

DOOR AND SHUTTER TREATMENT

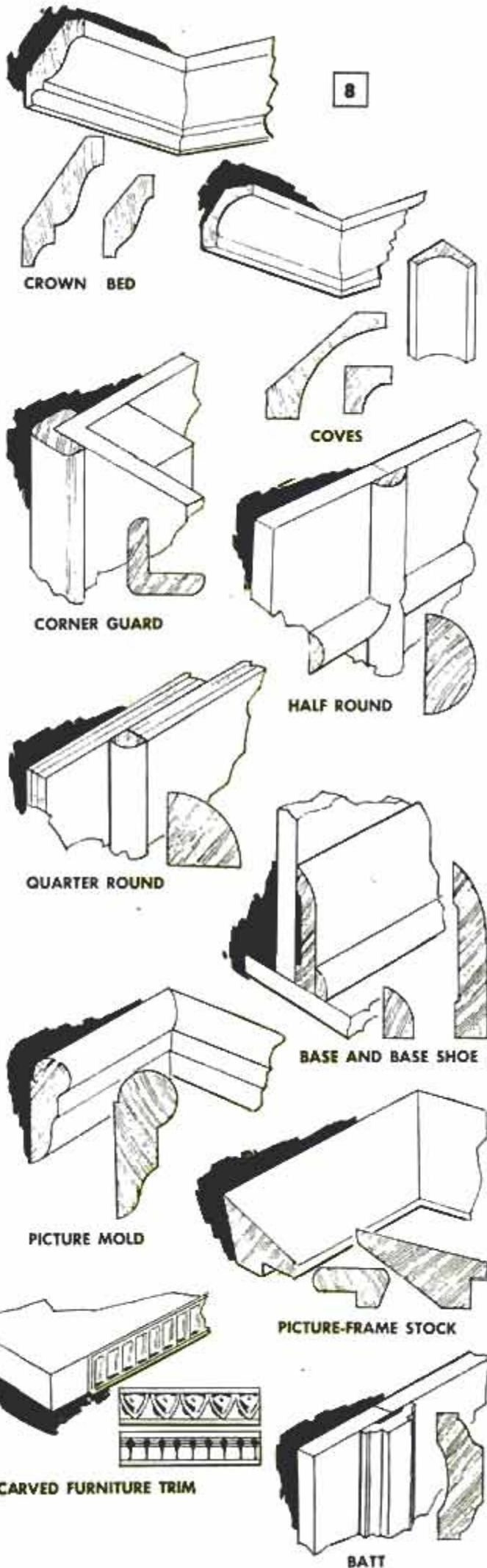
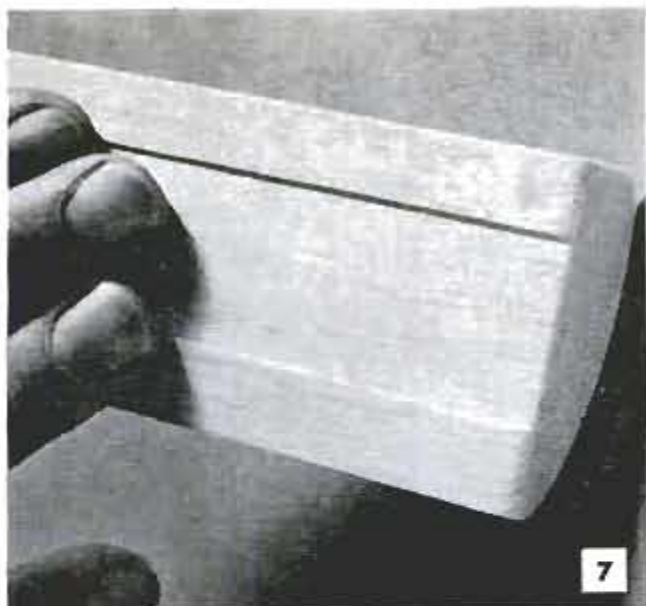


serve nicely) but are the horizontal strips near the ceiling for hanging pictures. Casings are the trims for doors and windows. Sometimes base molding is used for a casing and vice versa. Mullion casing was originally made to cover the narrow space between two side-by-side windows but today is used for battens, wainscoting trim and the like. Screen stock, Fig. 12, balusters and others are quite similar to ordinary-dimension lumber, the difference being a better grade of wood and more careful sizing. Stops are the strips in doors and windows for stopping or guiding same, drip caps go over doors and windows; stools are the flat part of a window sill on the inside, Fig. 13. All of these and many more standard moldings are available today in a great variety of patterns and sizes. You'll find that most flat moldings are hollow-backed, Fig. 7. The hollow lets them fit snugly against a plaster wall instead of riding on top of any small surface irregularities. Two special groups of moldings also have many uses around the home. One is picture-frame stock, more expensive than standard molding but available in unique shapes and often prefinished. The other is machine-carved hardwood trim, designed for trimming the edges of furniture.

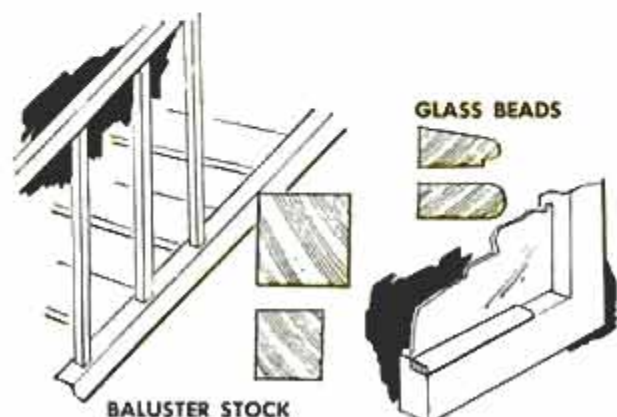
Moldings are highly versatile. Fig 1

6

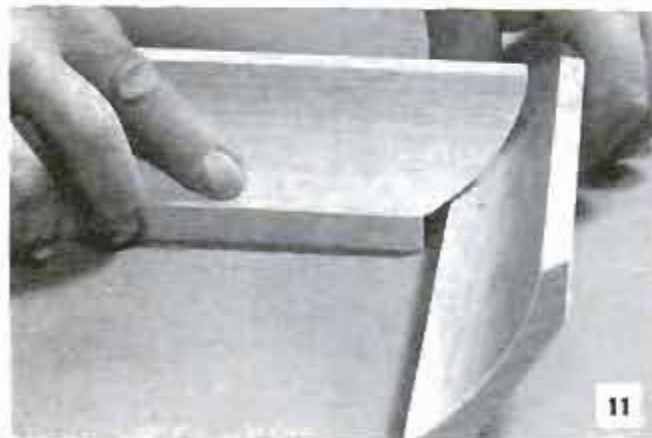
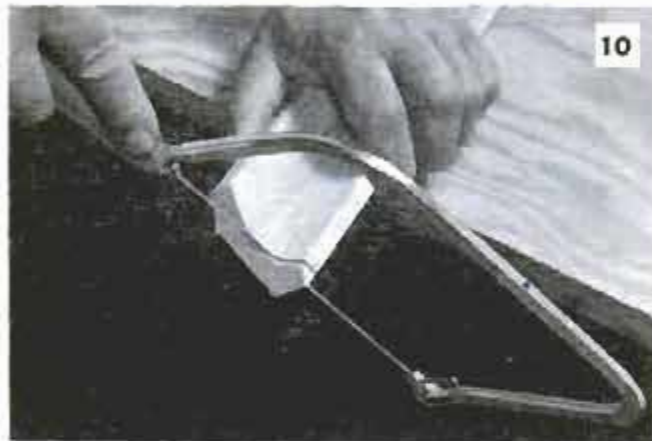




shows how a board-and-batten treatment of common screen-stock will relieve the plain, uninteresting look of a one-piece overhead garage door. When the same treatment is carried out on a board-and-batten exterior, the door becomes less conspicuous by blending in with the rest of the house. An overlay of molding in the design of a gate as shown in detail A, Fig. 1, adds the feeling of lowness and width to a garage door. Fig. 2 shows how molding can be used on a ceiling to give the illusion of height. Applied in the form of nesting frames, the molding permits the ceiling to be painted several colors without losing the unity the plane gives to a room. Detail B, Fig. 1, shows how regular screen molding can be used to transform dated porch screens to modern Shoji screens. The screen areas are divided into a grid pattern by nailing the molding back to back with the wire between. An example of how half-round molding will serve to emphasize length and lowness of a built-in sofa is shown in Fig. 3. Here the molding is run horizontally on the walls and the areas between are painted different colors. Novel bed headboards consisting of molding attached directly to a bedroom wall and framing inserts of cloth, cane mat or wallpaper, is another way you can use molding to good advantage. Clever cabinet and



BALUSTER STOCK
JANUARY 1959



Western Pine Association photos

drawer handles that are both decorative and practical are nothing more than strips of picture molding applied in the manner shown in Fig. 4. What you can do with molding to decorate your window shutters and entrance doors is suggested in Fig. 5. Note particularly how quarter-round molding applied to the face of a plywood panel closely simulates louvered shutters. Interiors can be given added interest and the feeling of warmth by facing the doors with squares of cloth or paper which match the room drapes or wallpaper. In the example shown in Fig. 6, squares of cloth matching the pattern of the bedspread are framed by applying strips of molding over the edges of the cloth. Gives the effect of paneled doors and makes them belong to the rest of the room.

Coping Molding

The trick of good joinery with moldings is to miter all outside corners and to cope all inside corners. Figs. 9, 10 and 11 show how to cope molding when fitting it around the ceiling of a room. First, the piece of molding is held against the back-guide of a miter box in the same position it will be when installed, and it is cut off at a 45-deg. angle with the saw. In the photo the piece to be coped is at the right, behind the saw. If you were making a mitered outside corner with this same type molding, you would cut it the same. The piece to be coped is trimmed off with a hand coping saw, using the inside edge of the miter sawcut as a guide line. Saw perpendicularly, trimming away the wedge of wood left by the 45-deg. cut. The piece also can be coped on the jigsaw by laying the back side of the molding flat on the table. When coped, the end will have an exact reverse profile of the molding against which it is to be butted,

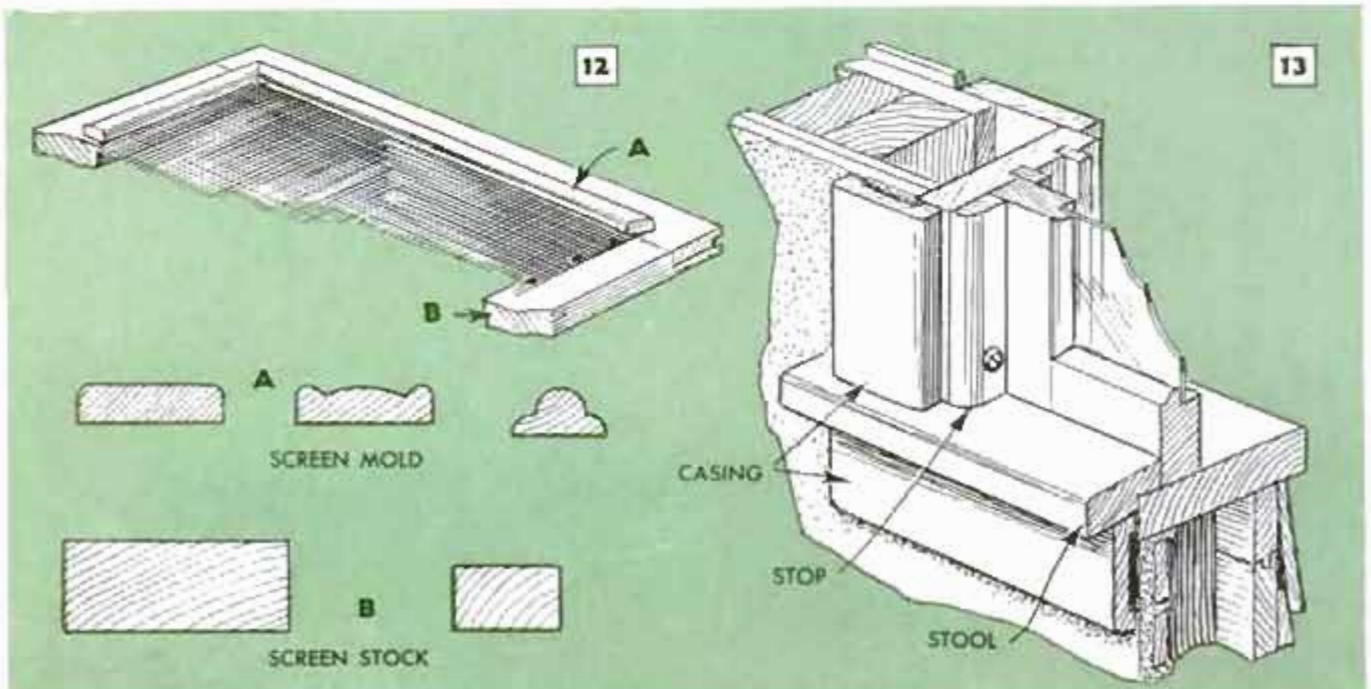
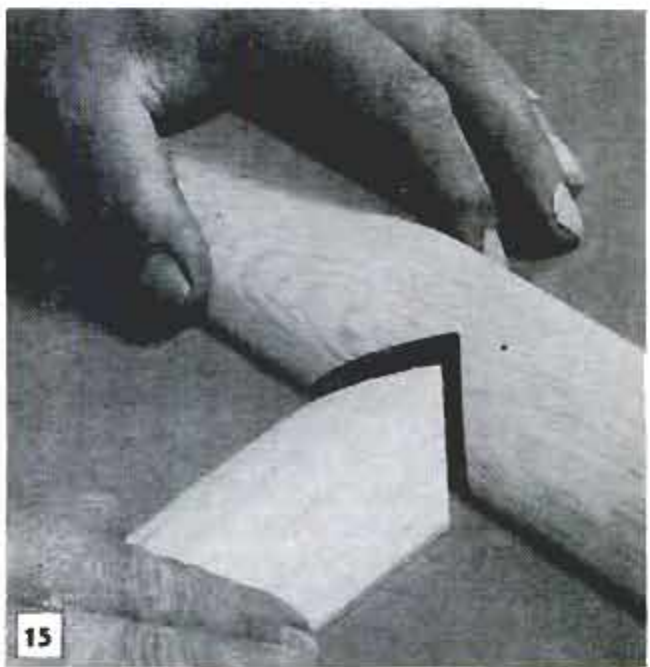


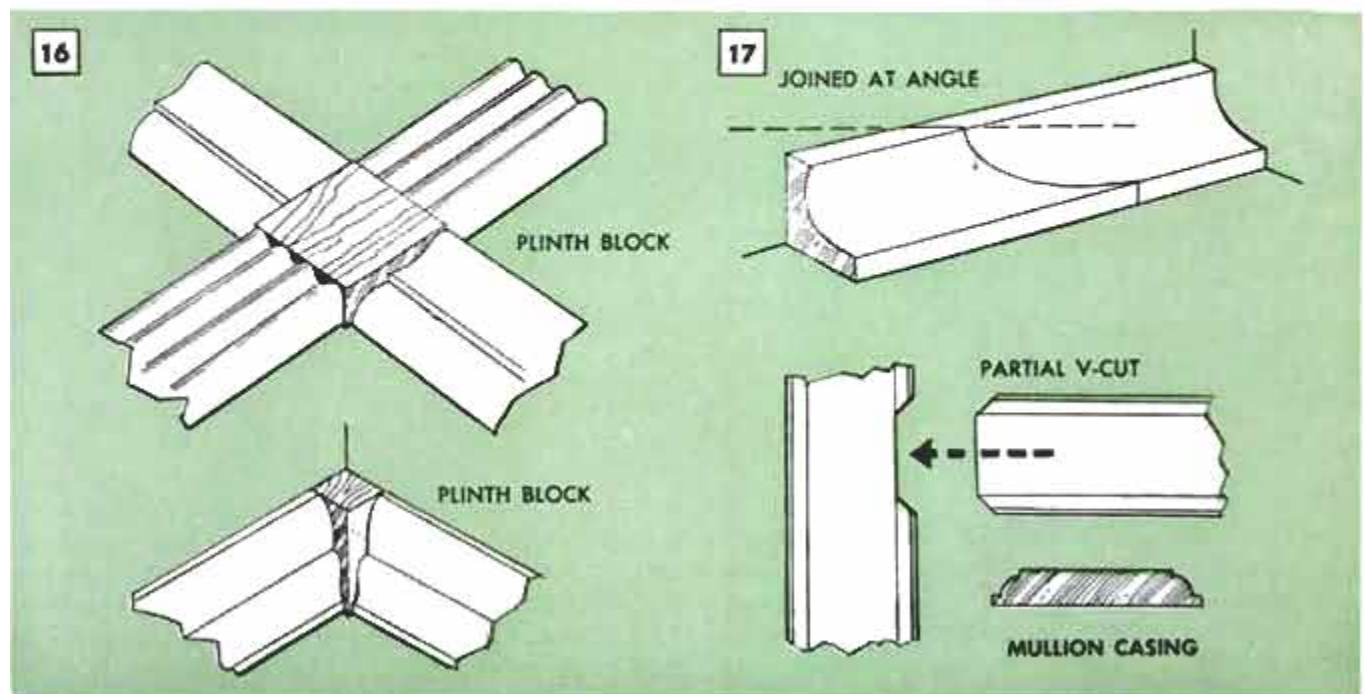
Fig. 11. In placing molding completely around a ceiling, two methods can be used. You can cope only one end of the four lengths, cutting the others square, or cope both ends of two lengths, leaving the ends of the other two lengths square. In the later case, the uncoped lengths are applied first. In all cases, the coped ends butt against the face of the adjacent molding. The reason for coping instead of mitering an inside corner is that corners of rooms are seldom square and you can compensate for this more easily with a coped end since you can trim away front or back edges to make the joint fit perfectly. Even if the joint is a little ill-fitting, or if some shrinkage in the wood should occur, the joint will still look neat because the cut itself cannot be seen except when sighting along the line of the molding.

Joining Molding

When two or more pieces of molding intersect as in Figs. 14 and 15, it is best to use a symmetrical molding, such as a round casing, or a half-round. Then the pieces can be smoothly joined together. The piece to be let-in is trimmed to a point by two 45-deg. cuts and it is used as a pattern to mark the notch in the other piece. When different or asymmetrical moldings are being joined, a plinth block is used as in Fig. 16. Likewise, a plinth block can be used in a corner to avoid coping. Standard moldings come up to 16 ft. or more in length but sometimes it is necessary to splice, or join, two pieces. Fig. 17 shows how both pieces are mitered 45 deg. and lapped. When glued, a stronger joint results and is less noticeable. A partial V-cut gives the most attractive joinery where pieces of mullion casing or the like, which are shaped only along the edges, are to intersect. ★ ★ ★



Western Pine Association photos





Sectioned Insert on Window Gives Multipane Effect

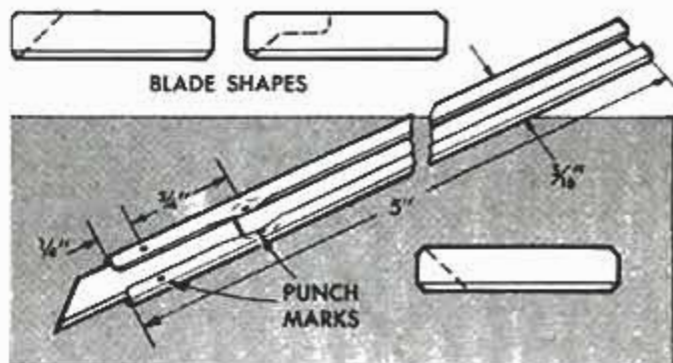
To change double-hung sash with single panes into windows that appear to have multiple panes for a colonial effect, one homeowner made inserts to fit flush against the inside of the windows as illustrated. All members of the inserts are $\frac{5}{8}$ x $\frac{5}{8}$ -in. pine. Joints are half-lapped and glued. Friction catches fitted on the sides permit easy removal and replacement of the inserts when desired. Such inserts also can be made for use on a picture window to provide the appearance of multipane windows at each side, or the entire window can be covered as desired.

Don Brooks, Lombard, Ill.

ⓘ Before glazing new wooden windows, paint the wood that will be in contact with the putty. If this is not done, the wood will quickly draw the oil from the putty, causing it to crumble.

Metal Handle Converts Injector-Razor Blade Into Stencil Knife

When fitted with a handle, injector-razor blades are handy for stencil cutting, silk-screen work and other cutting jobs requiring a sharp knife. A blade can be ground to almost any shape desired. To do this, first sketch the shape on the blade. Then insert one end in the handle and shape the other end on a fine-grit wheel. The handle is formed from a $\frac{9}{16}$ x 5-in. strip of sheet metal, as indicated in the drawing. To form the channels along the sides of the strip, clamp it between two $\frac{1}{2}$ x $\frac{5}{16}$ x 5-in. lengths of flat steel and then fold over the edges. The channels are then closed with a center punch a distance of 1 in. from one end of the handle to prevent the blade from sliding into it beyond the desired point as shown. After the blade is inserted in the handle, punch marks are made on the chan-



nels at a point $\frac{1}{4}$ in. from the blade end to further secure the injector blade in the handle. When not in use, remove the blade from its cutting position and tape it to one side of the handle to prevent injury.

Leon Reissman, Brooklyn, N. Y.



Household Cleanser on Tape Ideal for Small Polishing Jobs

When very fine grit abrasive cloth is needed for polishing small metal parts with round surfaces, one home craftsman uses a strip of friction tape coated on both sides with a powdered cleanser, such as is used for scouring pots and pans. The cleanser is applied by sprinkling a light coating of it on a flat surface and then firmly pressing the tape on the cleanser several times until completely coated.

Walter E. Burton, Akron, Ohio



FROM RIFLE TO **HANDGUN**

By Alfred J. Goerg—
*3009 S Laurel St
Pasadena, Wash.*

A HARD-HITTING HANDGUN for use as a side arm when hunting large game or working a trapline where dangerous animals may be encountered, is quite easily converted from a single-shot rifle chambered for high-velocity cartridges. The conversion pictured above was made from a Remington rifle with a rolling-block action and chambered for the 7-mm. Mauser cartridge. Before converting this rifle make sure the action is tight, that all parts are in reliable working order and that the chamber is in good condition. If there is any doubt, have the arm checked by a com-

petent gunsmith. Unless you have facilities for altering the tang as in Fig. 3, it may be a good idea to have this done by your gunsmith. It's a rather tricky job as it involves altering the original flat lock spring. The rest of the work you can do yourself with a few simple tools.

After acquiring the rifle of your choice for conversion, remove the stock and forend wood and then cut off the barrel to the desired length and crown it. Care in selecting a rifle with a good barrel may save work and the expense of rebarreling the action. Next, a standard rifle ramp with a wide

Fig. 1, completed single-action handgun converted from Remington rolling-block single-shot rifle has shortened barrel, Micro and partridge-type sights, custom-made stock, streamlined hammer spur and shortened forend wood. Fig. 2, first step of conversion is to remove stock



Right, tang is modified to take sharp curve of pistol stock. Lower member of tang and hammer spring are annealed and bent to curve downward. Upper member of tang is cut off close to receiver and a length of rod is welded to it to provide better base for mounting pistol stock





Above, left and right halves of stock are carefully grooved to provide tight fit when bolted together on tang of gun. Right, heavy gun requires custom-made holster of stiff leather bound with heavy thongs



partridge-type front sight attached is silver-soldered to the barrel. The rear sight used is a Micro adjustable sight installed by drilling and tapping two shallow holes in the receiver directly above the chamber to take the mounting screws. To accommodate the curve of the revolver-style grips, the tang members must be bent into a downward curve as in Fig. 3. Since the upper member of the tang would be too short after bending, it is cut off near the receiver and a rod of the proper diameter and length is welded in the position shown. After this is done, it is necessary to reshape the hammer spring to make it work properly. Note that the hammer spur has been bent downward to streamline the gun, Fig. 3. Care must be taken to anneal all steel parts that are to be bent to avoid breaking them.

Grips for the gun may be hand-carved from walnut to any style desired, or the gun can be sent to a custom-grip maker for this phase of the work, Fig. 4. For a more professional appearing and easier job of carving the grips, first make wax models of them. To do this, wind masking tape over the parts of the tang having open spaces and then dip the entire tang in melted wax a sufficient number of times to build up a mass from which the grips of the desired style can be carved. When sat-

isfied with the appearance and feel of the wax prototype, cut it in half with a hacksaw blade to form the left and right halves of the grips. Then, carefully remove them from the gun. Use the wax models for patterns and as a reference when cutting and carving the walnut grips. Carefully cut the grooves in the grips so that they tightly clamp the tang when bolted in place. Next cut down the forend wood (the wooden piece fitted against the underside of the barrel) to a pleasing proportion, Fig. 1. The lug on the forward end of the receiver is then drilled and tapped to take a rod threaded on both ends and slightly longer than the forend. A knurled ejector-rod head of the type used on some revolvers is turned on one end of the rod and the other end is inserted in a hole drilled in the forend wood and then turned in the tapped lug to securely fasten the forend in place.

Since a pistol of this size and shape will not fit in a stock holster, it is necessary to custom-make one as shown in Fig. 5. Use heavy, stiff leather for the body of the holster and close the seam at the back with a leather thong as shown, or have it sewn at a shoe-repair shop. Parts of the holster may be tooled. A thong lacing and a loop for one spare cartridge give the holster a Western appearance. ★ ★ ★

Jig Aids Cutting Rock-Wool Batt

Cutting a rock-wool insulation batt with a handsaw is easy when this jig is used. It consists of cleats nailed across the ends of two boards to space the latter 1 in. apart. It is used to support the insulation and provide passage for the saw. The jig may be used on saw horses or other supports.

Renew Wire Brush by Grinding

To give an old steel-wire brush a better "bite," hold it against the side of a rotating grinding wheel to remove the rounded ends on the bristles. When doing this, hold the brush lightly against the grinding wheel and wear safety goggles.

M. Robert Beasley, Jackson, Mich.

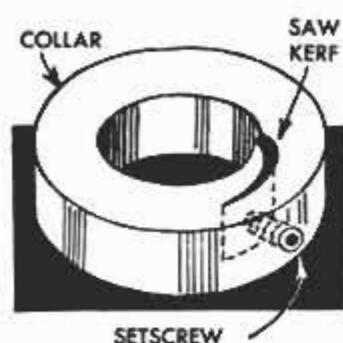
Photo Lamp on Rafter Illuminates Attic

Instead of searching in half-darkness when looking through trunks and boxes stored in an unlighted attic, use a photoflood reflector, with 100-w. lamp, that can be clipped on a rafter as shown. The lamp also may be clamped to the back of a chair or other object. If there is no electrical outlet in the attic, run an extension cord from an outlet downstairs, but be sure to disconnect the cord when the lamp is not in use. You will find this means of illumination much handier than a flashlight, which has to be hand-held.

Mrs. M. Fey, New York City.



Kerf Anchors Collar on Shaft

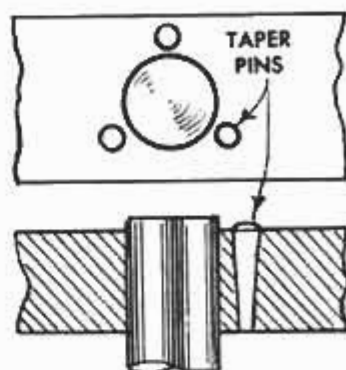


When securing a collar on a threaded shaft by means of a setscrew, the latter can be prevented from damaging the threads if a saw kerf is cut in the collar as shown. Make the cut well beneath the depth of the

threads, after which you drill the hole up to the kerf and tap it with a bottoming tap for the socket setscrew.

Enno R. Haan, Evanston, Ill.

Tighten Shaft With Taper Pins



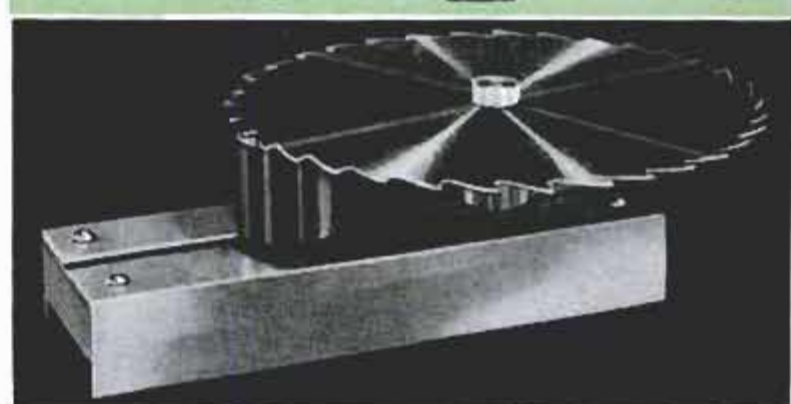
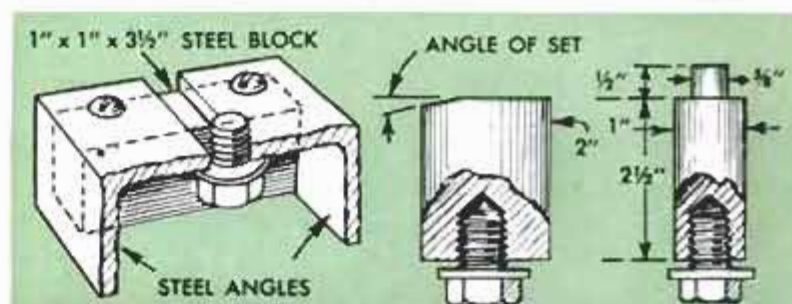
When a shaft that rotates in a hole bored in the casting of a machine becomes loose, it can be tightened by driving taper pins into holes drilled in the casting. Holes for the pins should be spaced equally

around the shaft hole about $\frac{1}{4}$ in. from it so the taper pins expand the metal when driven into the casting.

Frank L. Rush, Columbus, Ohio.

Jig for Accurate Setting Of Most Circular Saws

Here is a saw-setting jig that is adjustable to take most common sizes of circular saws. Because of the accuracy of work that can be performed with it, you will find it easy to keep your saws always in perfect shape. The base is made of two $\frac{1}{4}$ x $1\frac{1}{2}$ x $1\frac{1}{2}$ steel angles 10 in. long. Steel spacer blocks, each 1 x 1 x $3\frac{1}{2}$ in., are bolted in the ends to provide a slot for positioning the bolts that clamp the saw support and tooth-setting anvil to the base as shown in the details. Each angle of set required is filed on the face of the anvil as indicated. — W. Judy, International Falls, Minn.



On the **MARKET** for Do-It-Yourselfers



1. INSTANT UPHOLSTERY CLEANER removes all the common stains from upholstery materials such as woven fabrics, leather, vinyl and nylon. Penetrating action lifts dirt and discoloration from the surface

Glamur Products, Inc.,
1024 Montgomery St., Syracuse, N. Y.

2. WOOD STAIN AND LACQUER are combined in a 16-oz. pressurized container for finishing, refinishing and touching up old finishes. Comes in brown and red mahogany, brown and red maple, blond and walnut

Kay Chemical Co., North Hollywood, Calif.

3. PARQUET PATTERNS IN LINOLEUM TILE are available in four distinctive colors, or wood tones, can be arranged to form a variety of decorative effects. Patterns are made in service gauge, in 9 x 9-in. size

Armstrong Cork Co., Lancaster, Pa.

4. ALUMINUM REFLECTOR is 8 in. in diameter and is designed for drop lights and other installations having no reflectors or shades. To install, simply unscrew bulb, slip reflector over it and replace

Hocar Mfg. Co., 2569 N. Clark St., Chicago 14

5. DRY LUBRICANT comes in a small plastic tube with an elongated nozzle for reaching those hard-to-get-at places where lubricant is so often needed. Just the thing for hinges, locks, certain workshop tools

Bradley Container Corp., Maynard, Mass.

6. ALL-PURPOSE PRIMER speeds up job of refinishing, provides ideal surface over which to spray enamels or lacquers. Comes in pressurized container, takes only a few minutes to dry. Use on metal, wood

Krylon, Inc., 18 W. Atry St., Norristown, Pa.

7. ALL-STEEL DOOR for outside basement entryway comes complete with steel frame and fittings ready to install. Just remove the old door and frame, repair masonry if necessary. Complete instructions included

The Bilco Co., New Haven 5, Conn.

8. SEMICONCEALED CABINET HINGE is available in a variety of finishes to match modern decor. Offset leaf is convex, providing deeper countersink and a firmer grip for screws. Made from heavy-gauge steel

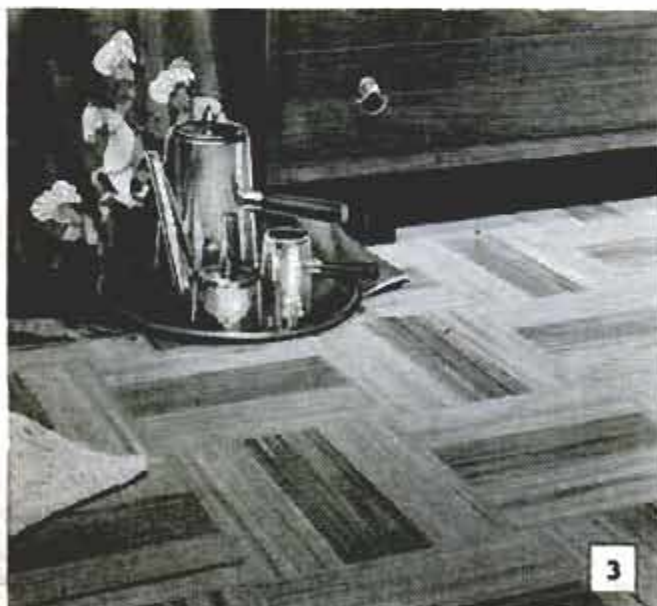
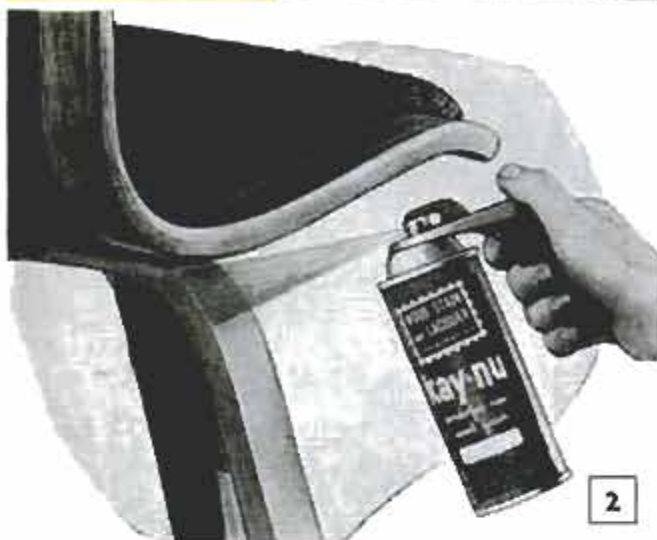
Ajax Hardware Sales Co.,
4355 Valley Blvd., Los Angeles 32, Calif.

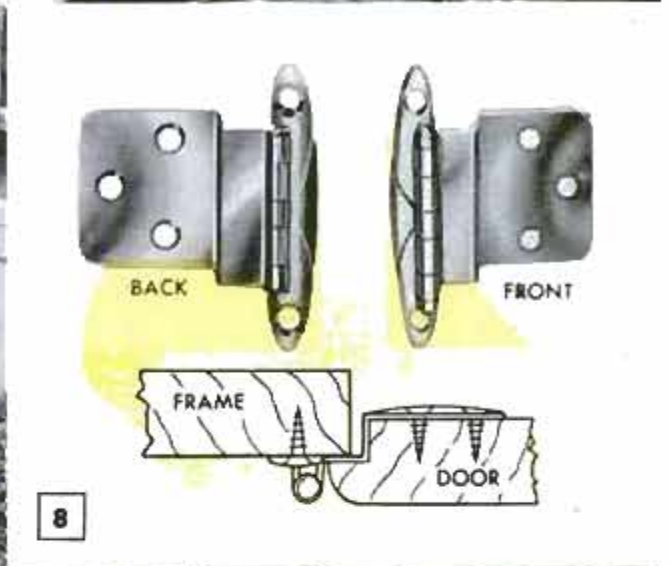
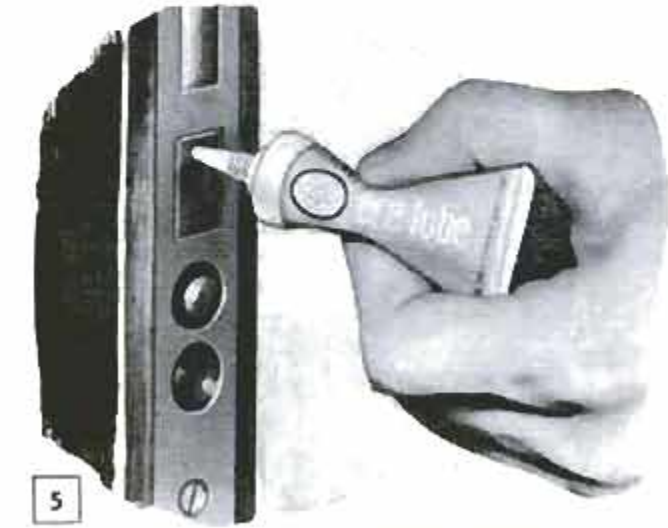
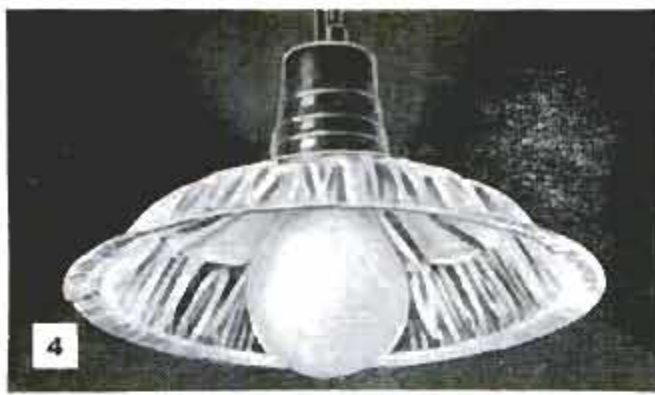
9. SHUTTER PANELS come unfinished in 12 sizes to fit nearly all conventional openings such as windows, bars, pass throughs and kitchen cabinets. Panels have light stops at top and bottom and plain louvers

Paul Heinley Indoor Movable Shutters.,
P. O. Box 100, Santa Monica, Calif.

10. AN ATTRACTIVE AND NOVEL FENCE is made from a new corrugated steel which is zinc-coated to protect it against rust. Just set the posts, install nailing strips, unroll the sheet and nail in place

Ceco Steel Products Co., 5601 W. 26th St., Chicago 50







Dropping-Pear-on-Knife Trick Is Interesting Party Game

Here is a trick that can be used as a game at your next party. Have the guests try to cut a pear in half by dropping it at arm's length on a carving knife as shown. After your guests fail to accomplish the trick, simply wet the pear and "sight" on the target by holding it so that water drops fall directly on the blade at which time the pear is released to be cut neatly in half as indicated.—Perry Deming, Bristol, Conn.

When the trunk light of one motorist's car stopped providing full illumination, he soldered one end of an electrical wire to the frame and the other end to the trunk lid to establish a better circuit. Such lights utilize the car frame and body for one side of the circuit and when rust and grime accumulate on hinge pins of the trunk lid, the flow of current to the light is reduced.

James P. Arnold, Fort Wayne, Ind.

Paper Helps Remove Small Parts Picked up With Permanent Magnet



If you use a permanent magnet for picking up tacks and similar small parts, here is an easy way of removing them. Fold a piece of paper over the ends of the magnet and pick up the parts as shown in the photo. Then hold the magnet over a container and pull off the paper. This method is ideal for picking up sharp tacks.

Frank A. Javor, Newark, N. J.

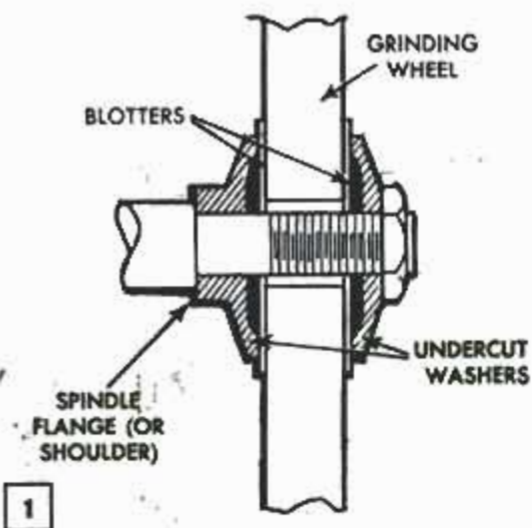
Carburetors on many late-model cars are equipped with dry-type air filters that require periodical cleaning or replacement for smooth idling and efficient operation. When dirty, the air cleaner restricts the air supply to the carburetor, resulting in an over-rich fuel mixture that will cause increased gasoline consumption.



Simple "Stone" for Honing Edges of Cutting Tools

Dull chisels, knives, plane irons and similar cutting tools can be given an extra-keen edge by honing on a strip of crocus cloth and then on a strip of leather. If the cloth and leather strips are tacked side by side to a heavy wooden block, they may be used in a manner similar to an oilstone. It is a good idea to provide some kind of cover to keep dust and dirt off the abrasive surfaces when not in use.

John A. Comstock, Wellsboro, Pa.



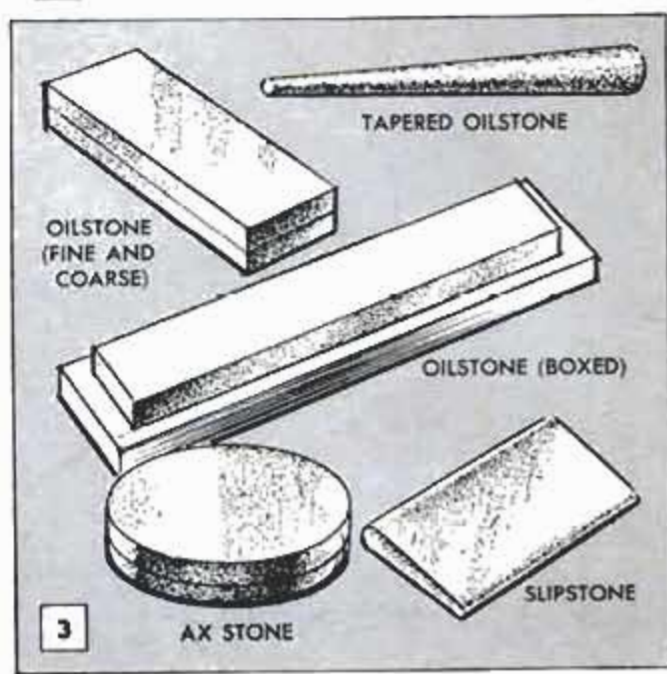
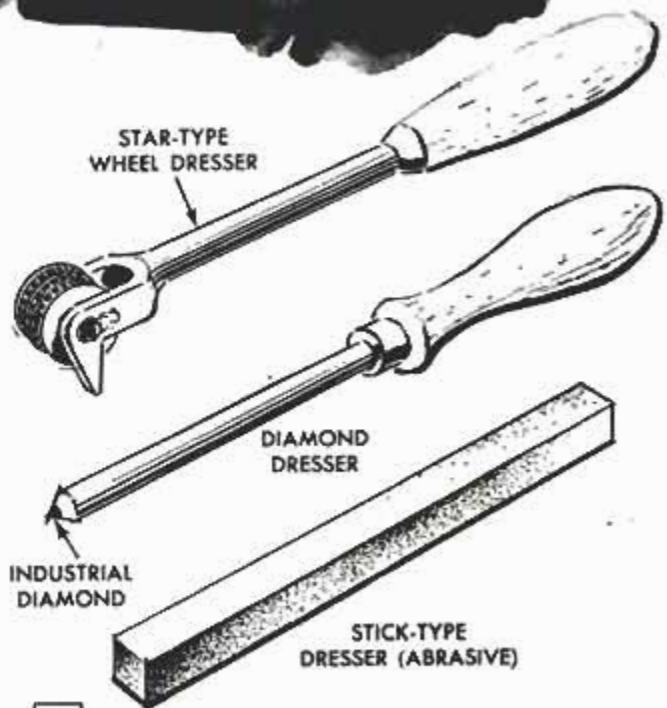
It's the CUTTING EDGE THAT COUNTS

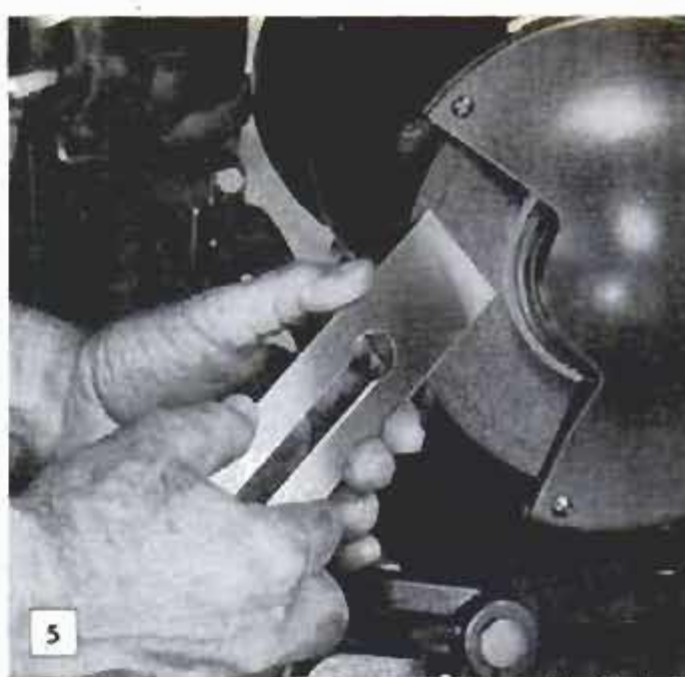
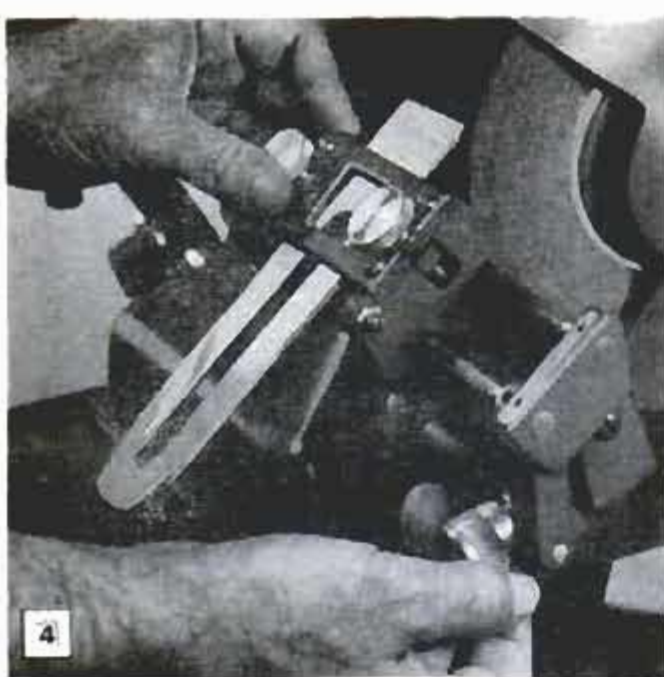
Tricks in Sharpening Edge Tools That Every User Needs to Know

By C. W. Woodson

TAKING THE TIME to sharpen a cutting tool to a keen edge pays off in greatly improved performance, better workmanship and, in the end, an actual saving in job time. In general the procedure is divided into three simple steps: Grinding the beveled cutting edge to the correct angle, whetting on an oilstone to remove the wire edge formed by the grinding operation and finishing on a hone or leather strop to produce a smooth, razor-keen edge. These three steps apply to nearly all types of cutting tools, either hand or power-operated. In some instances, such as sharpening auger bits, filing is substituted for grinding as the first sharpening operation, but the end result is the same.

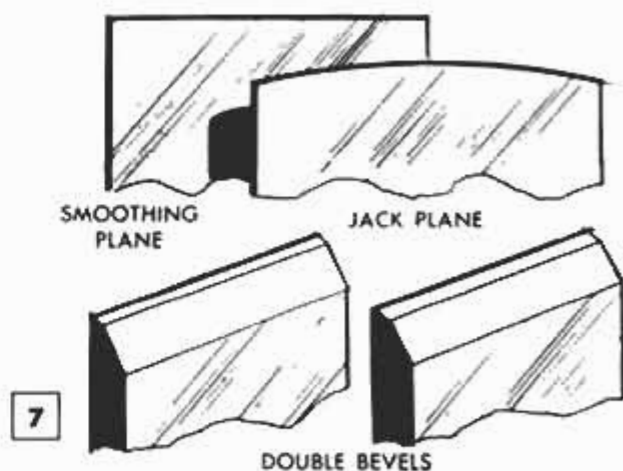
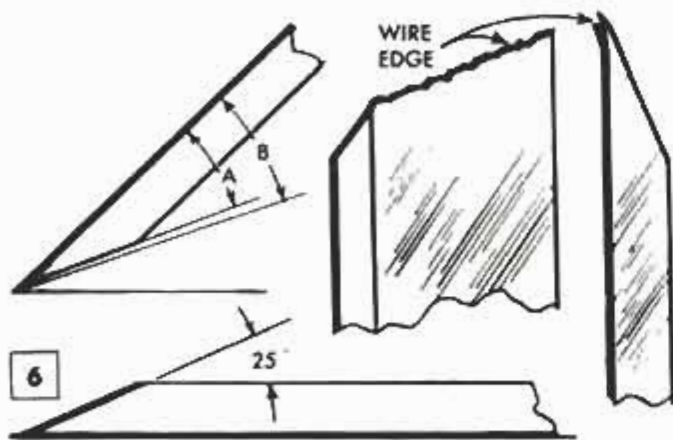
For the initial step in sharpening tools, your grinder must be in good condition. A direct motor-driven unit with fine and coarse wheels turning at 1750 r.p.m. is preferred by many skilled craftsmen for sharpening edge tools. Others prefer the higher speed grinders with wheels turning at 3450 r.p.m. Abrasive wheels driven at the higher speeds cut a trifle faster and





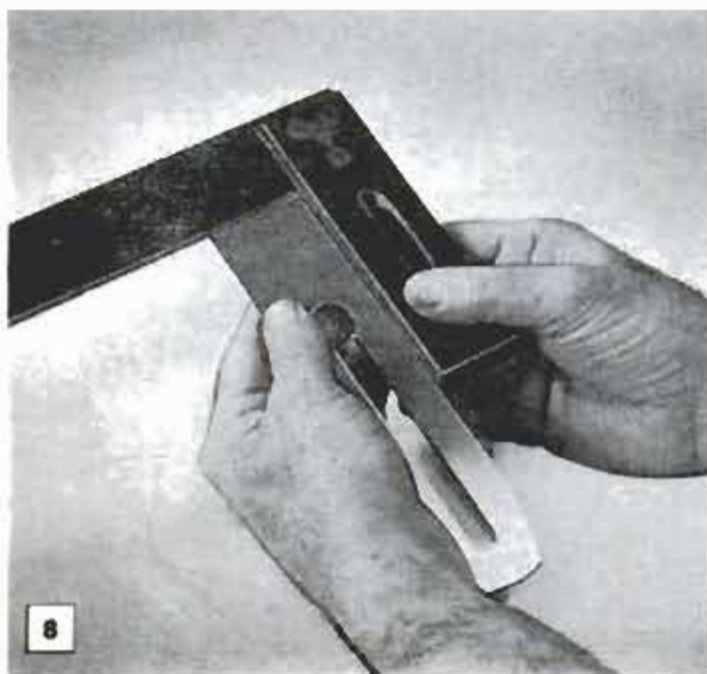
Photos courtesy Stanley Electric Tools

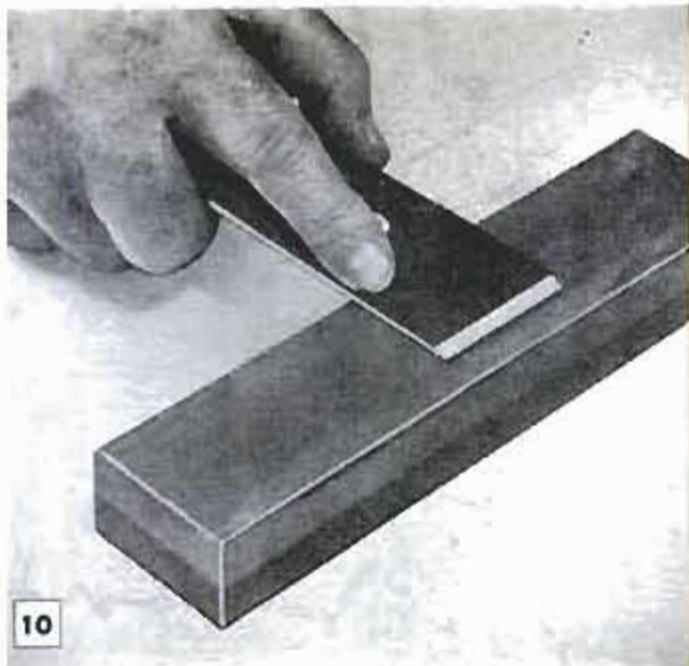
An attachment for grinding plane irons and chisels enables you to do an accurate job of squaring bevel and truing edge. Next best thing is to grind and square bevel on side of wheel. Use very light pressure



When grinding and finishing the edge of a plane iron check the squareness. Squaring the edge will make it unnecessary to tilt the iron sidewise in the plane

Second step after grinding plane irons and chisels is finishing edge on oilstone. If edge is used for rough work, form double bevel as detailed above





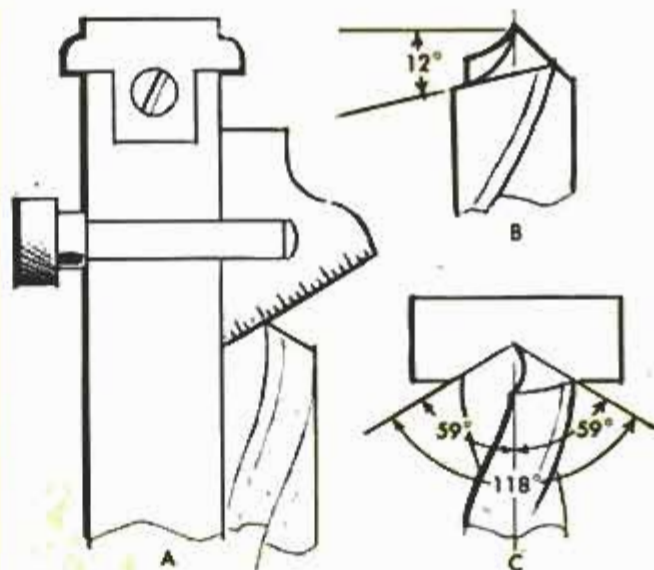
10 As final step turn blade over, lay flat on oilstone and stroke lightly. Be sure not to form a bevel

smoother, but additional care must be taken to avoid overheating the tool and drawing the temper.

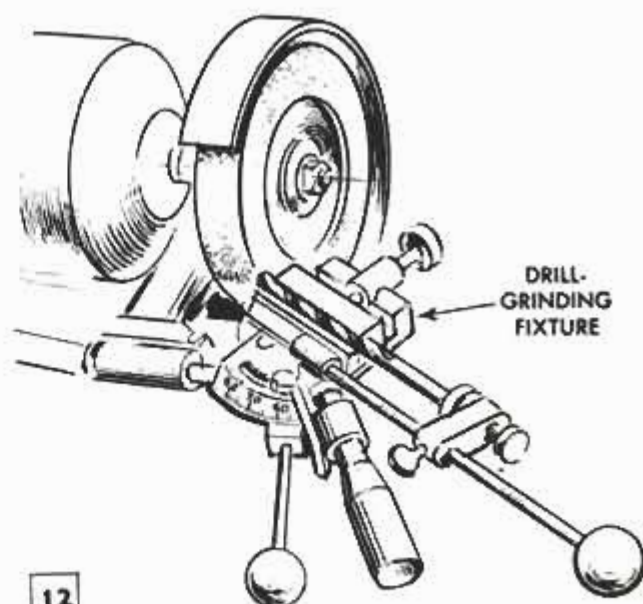
It's important that the wheels run true on the spindle and this should be checked occasionally. On all small grinders the wheels are held in place on the spindle with two undercut washers and a nut, Fig. 1. The wheels are cushioned by blotters (disks cut from blotting paper and cemented to the wheel) and a lead bushing. Be sure not to damage the bushing or the washers when removing or replacing the wheel on the spindle. When the wheel becomes glazed (loaded with fine particles of metal) and the corners rounded due to prolonged use, the wheel should be trued up, or dressed, with a wheel dresser. Several types of wheel dressers are detailed in Fig. 2. Handle these tools carefully as they cut very fast, especially the diamond dresser, Fig. 20, which is perhaps the best of the three types.

For the second operation in sharpening tools you will need an oilstone and a hone, or slipstone, Fig. 3. The type needed depends on what tool is being sharpened. Ordinarily, you will need the fine oilstone (boxed if desired) for such tools as plane irons and straight chisels, a tapered oilstone for gouges and a straight and tapered slipstone, the latter used for the final operation of honing, or slipstoning.

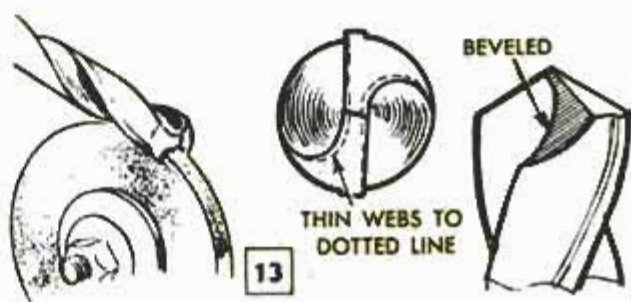
Grinding plane irons and straight chisels can be done very accurately on a grinder fitted with a blade-grinding attachment, Fig. 4. With this unit you get a square edge and a true bevel. If you do not have the attachment, then it is permissible (although not a recommended procedure) to



11



12



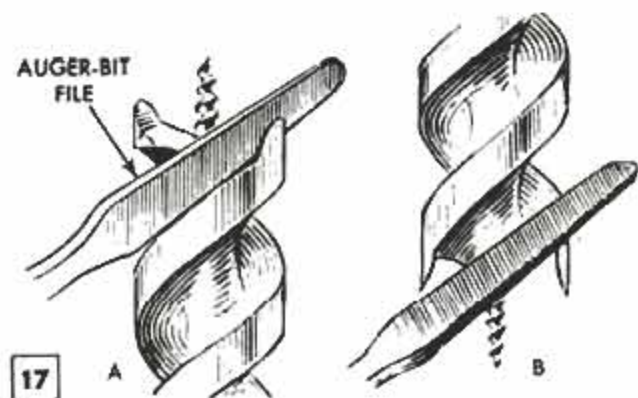
13

grind plane irons and chisels on the side of the wheel as in Fig. 5. Use care and light pressure. Check for squareness as in Fig. 8. Grinding leaves a wire edge shown exaggerated in the right-hand details, Fig. 6. This is removed on the oilstone as in Fig. 9.

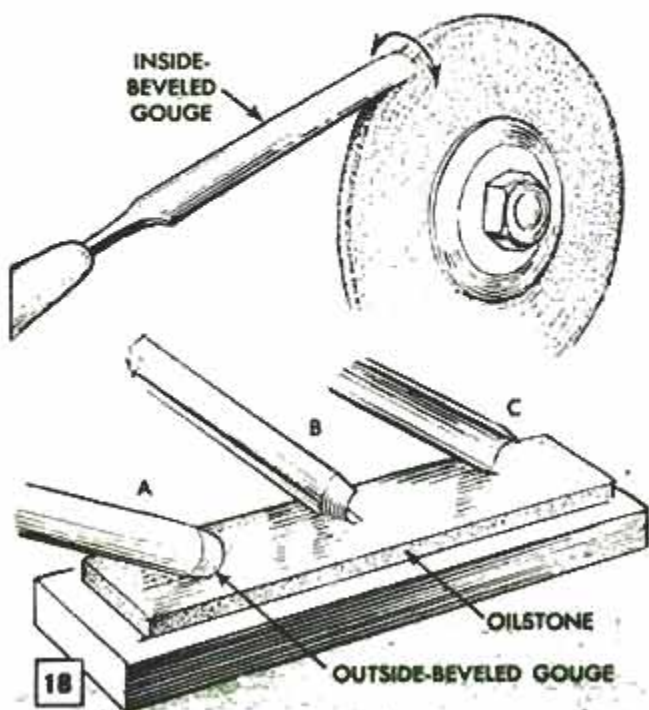
Edge tools, such as chisels, gouges and plane irons, that are to be used for heavy cuts in hardwood, usually are finished with a double bevel, Fig. 6, A and B, and also Fig. 7. Grinding and finishing the edge with a double bevel gives the cutting edge greater support due to the added thickness



It's permissible to sharpen outside gouge on side of wheel as in Fig. 14. Figs. 15, 16 picture two methods of finishing inside gouge. In the first, Fig. 15, gouge is moved, stone is stationary. In Fig. 16, stone is moved



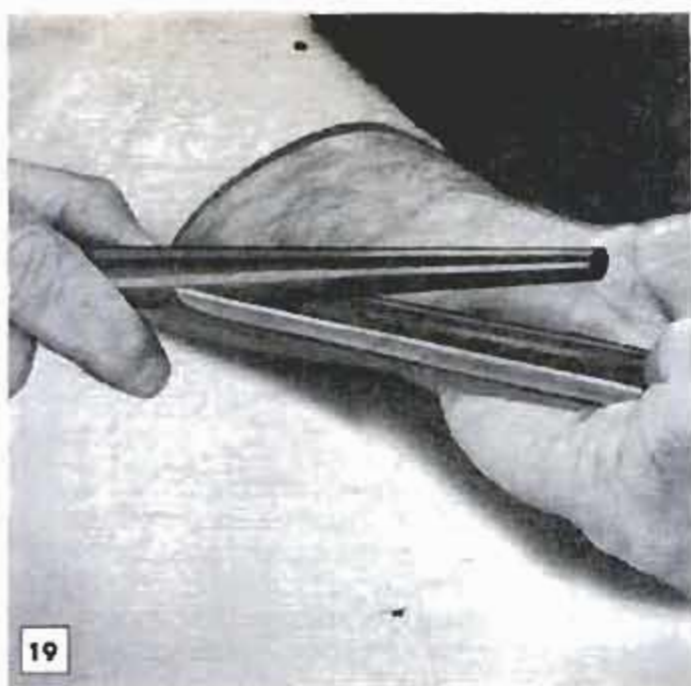
Above, auger bits are sharpened with special file and finished with abrasive stick. Below are methods of sharpening and finishing inside, outside gouges



of metal. In the two views in Fig. 7 the bevels are, of course, exaggerated. Normally the second bevel is formed in the second sharpening operation, Fig. 9, and should not be more than $\frac{1}{2}$ in. wide. Normally the bevel on plane irons and chisels is ground to 25 deg., Fig. 6, but craftsmen often vary this to suit special conditions. As a final touch in whetting a plane iron or chisel, turn it over, lay flat on the oilstone as in Fig. 10 and smooth up the edge with a few light strokes. For average work craftsmen often finish the cutting edges of plane irons, chisels and gouges with a slipstone and dispense with stropping on leather as a final sharpening operation. With care this third step produces a cutting edge very nearly equal in smoothness to that obtained by stropping.

Carbon-steel and high-speed-steel twist drills can be used in either wood or metal but will not perform satisfactorily in either material unless they are correctly sharpened. A drill-grinding fixture, or jig, Fig. 12, provides the best method, but you can do very well freehand if you use a gauge, detail A, Fig. 11, to bring the cutting edges to the correct rake angle and included angle, details B and C, Fig. 11. Thinning the webs of twist drills shortened by repeated sharpening can be done on a round-faced wheel. Grind a bevel back of the cutting edges as in the right-hand detail.

Sharpening an outside gouge (bevel on convex side of blade) can be done on the side of the grinding wheel as in Fig. 14. This is permissible if only light pressure is used. The inside gouge is ground on a round-faced wheel as in the upper detail, Fig. 18. Unless it is badly dulled or nicked,

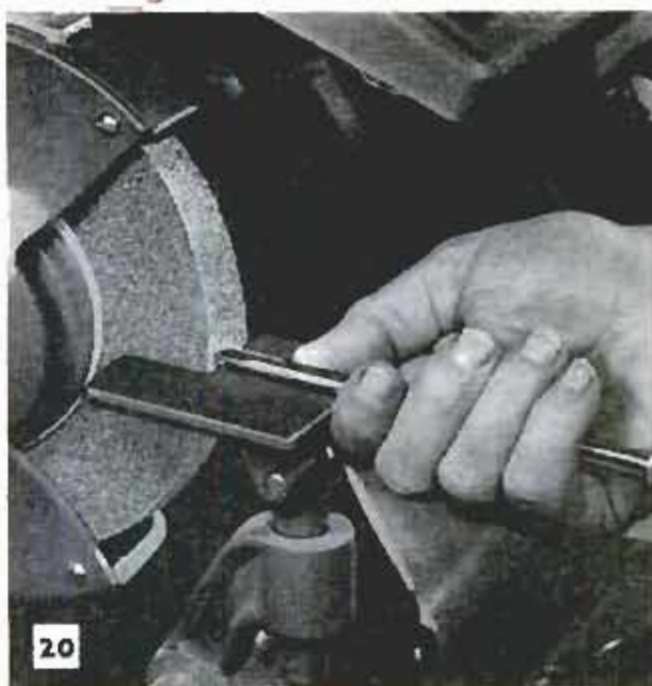


19 Unless dulled or badly nicked, small inside gouges can be sharpened several times with tapered stone

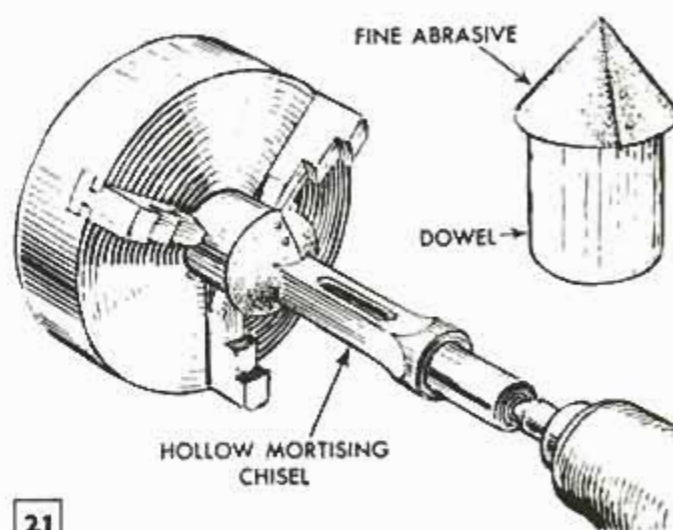
grinding is not always necessary as the edge can be sharpened with a tapered stone as in Fig. 19. The outside gouge is finished on the oilstone (fine side) by either of two methods. In the first, Fig. 18, detail A, the bevel is simply rolled right to left with only a slight sidewise movement across the stone. In the second method, details B and C, the bevel is rolled from B to C in a sweeping stroke right to left and back. Users generally choose between the two methods, using the one that produces the best results for them individually. There also are two ways of finishing an inside gouge, Figs. 15 and 16. Some craftsmen prefer to hold the tool stationary and move the slipstone, Fig. 16. Others hold the stone stationary and move the tool, Fig. 15.

Lips and cutters of auger bits should be sharpened with an auger-bit file, Fig. 17, details A and B, and finished with a fine abrasive stick, or slip. If you have a hollow-chisel mortising attachment for your drill press and have no way of sharpening the chisel, Fig. 21 shows a simple and practical way of doing the job. The short length of dowel also can be held in the drill chuck.

Owners of choice pocketknives use various methods of sharpening the blades. One method quite generally favored is shown in Fig. 22, that of sharpening against the edge rather than with it. Likewise, some users of axes prefer to sharpen away from the edge, lower detail, Fig. 22, but others prefer to reverse the direction of the sharpening stroke, that is, make the strokes against the edge rather than with it. Some use a circular stroke, gradually decreasing the pressure, in sharpening a pocketknife or ax when a very keen edge is desired. ★★

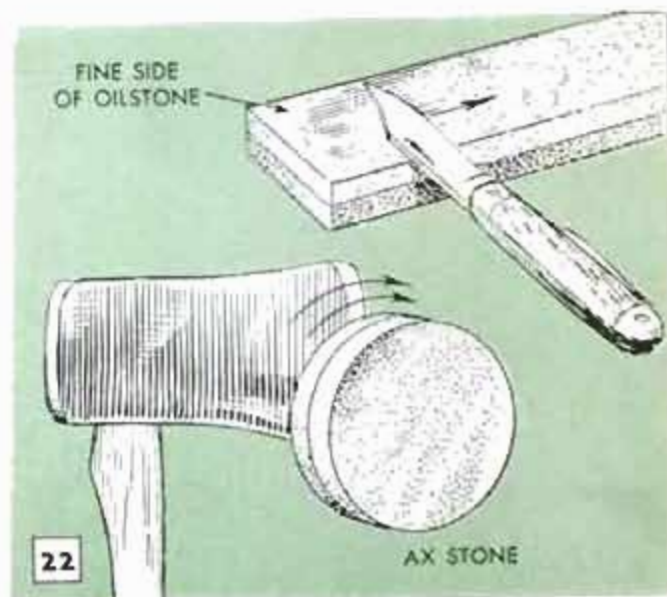


20 Always use a wheel dresser to true up a grinding wheel before sharpening any type of edge tool



21

Above, one practical way to sharpen a hollow chisel is to use pointed dowel faced with abrasive. Below, owners of knives and axes use various methods of sharpening. Detail show methods generally favored



22

Bracket Permits Clamping Sketch Board in Vise at Desired Angle

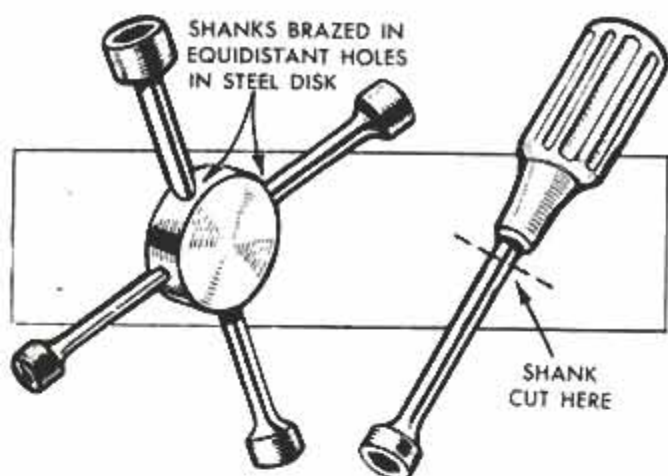
If you have occasional need for a small sketch board in the workshop, here is an excellent way of supporting the board at a convenient angle for drawing. Simply bend a length of $\frac{1}{8}$ x 1-in. flat steel to give the angle desired and drill two holes near one end for attaching to the back of the sketch board as shown. The other end is clamped in a bench vise.

When cleaning paintbrushes that have been suspended in turpentine, one home craftsman uses a square of insulating wall board to remove old paint and solvents. The porous material absorbs the solvent and the rough texture of the surface permits rubbing off the pigments without damaging the bristles. Lay the brush on a flat surface and stroke the board over the bristles in one direction only.

J. H. Capron, Winona, Minn.



Handled Socket Wrenches Assembled Into Four-Way Wrench



For more convenient use of screwdriver-type hexagon wrenches, braze the four most-used sizes to a steel disk as shown at left. Besides saving time, this arrangement affords greater leverage and causes less wrist fatigue than does the use of such wrenches in the conventional manner. The wrenches are arranged on the disk so that the sizes are in consecutive order. Size numbers may be stamped next to the shanks on both sides of the disk for easy selection. If the wrench is to be used on work requiring less leverage, simply reduce the length of each shank.

Level Drill Press With Bolts

About the best way of leveling a drill press or other shop machine is to place a bolt in each of the mounting holes and turn a nut on each as indicated in the detail at left. When the machine is in an upright position, the weight of it bearing against the nuts holds the latter in place, permitting the bolts to be turned as required to obtain level and solid position as shown in the photo. For heavy machines, the leveling bolts should be threaded for their entire length so that they can be positively secured in the mounting holes with locknuts to prevent vibration and lateral movement when a machine is in operation and pressure is exerted against work. Grind ends of bolts to a point to overcome any tendency of the machine to creep.



CLUTCH CONTROLS POWER TOOLS

A clutch permits smooth, gradual starts and stops, achieves a degree of spindle control not otherwise possible on small machines

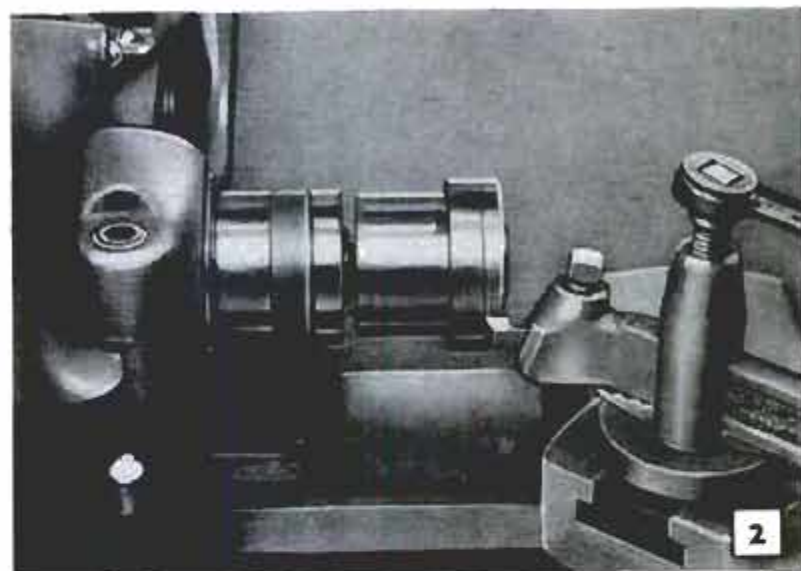
By Walter E. Burton

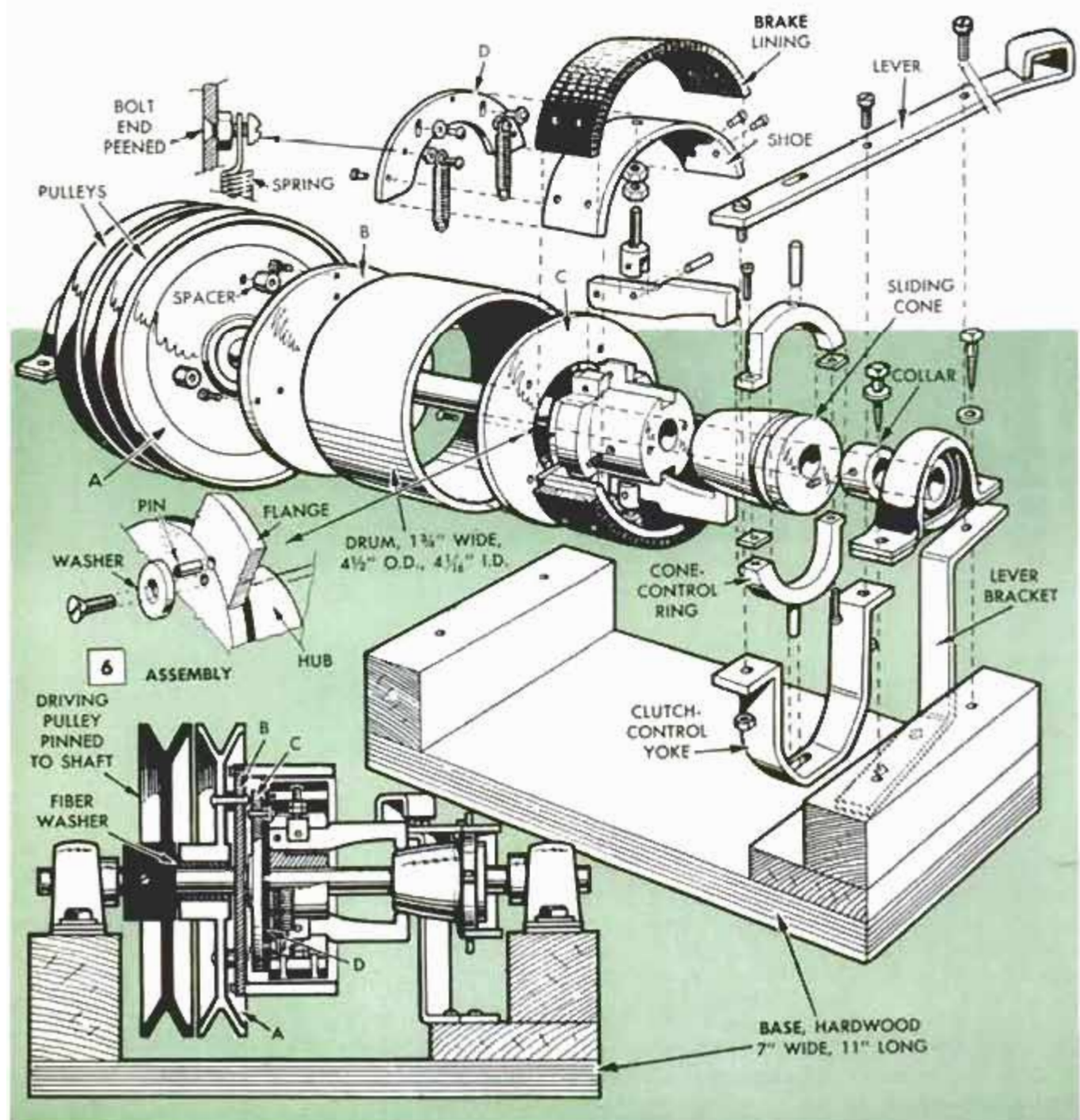
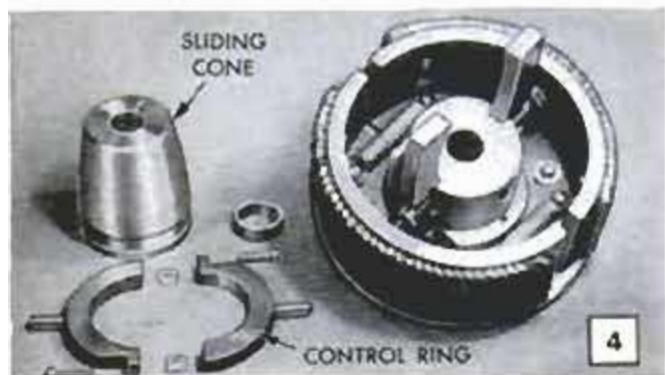
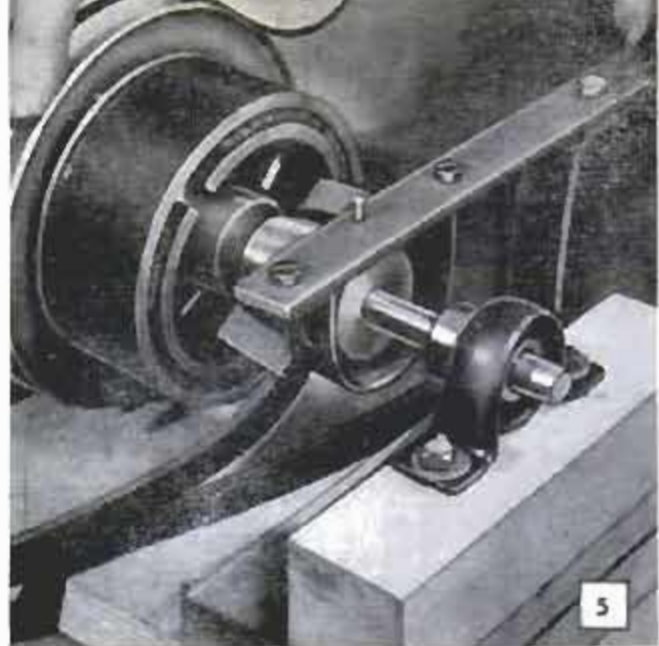
THIS CLUTCH is especially useful for controlling a small lathe or milling machine when you're doing close work and it is necessary to start and stop the machine frequently. As detailed, it is assembled with pulleys of the same diameter for use with a small bench lathe without changing the original motor-to-jack-shaft pulley ratio. Pulleys of varying diameters can be used to adapt the unit to other uses.

The braking mechanism consists of a drum controlled by internal-expanding shoes actuated by a hand lever. Parts of the clutch are pictured in Figs. 3, 4 and 5 and an assembly view and sectional view are shown in Fig. 6. The clutch is pictured being assembled in Fig. 1, the hub being machined in Fig. 2 and the clutch completely assembled and mounted to drive a small lathe is pictured in Fig. 7. The parts are assembled on a 10½-in. length of ½-in. steel shafting, the shaft being mounted on ½-in. ball-bearing pillow blocks. The pulley A, Fig. 6, on which the clutch mechanism is mounted, is bronze-bushed as it must turn freely on the shaft when the clutch is disengaged.

The clutch mechanism is attached to pulley A, Fig. 6, and consists of the back plate B, the hub flange C, the split ring D, the halves of which carry the shoes, the clutch hub, arms and sliding cone. These parts in their relative positions are shown in the sectional view, Fig. 6. The drum can be made from extra-heavy pipe or from steel tubing having a ⅞-in. wall. The backplate B, Fig. 6, is cut from ⅜-in. steel plate and is drilled near the edge for 6-32 screws, the holes being equally spaced. Using the plate as a template, drill and tap holes for 6-32 screws in one edge of the drum. On approximately the same spacing, holes are drilled for the

⅛-in. rivets which hold the plate to the web of the pulley, A. A center hole is drilled and reamed to ½ in. to fit the shaft. The brake shoes, or clutch shoes, are semi-circular segments cut from steel tubing having a ⅜-in. wall and an outside diameter of 3½ in. The shoes are faced with regular brake lining riveted in place. One edge of each shoe is drilled and tapped for three 6-32 screws so that the split rings, or segments, can be attached to the shoes in the same manner as the drum is attached to the backplate. Note that the assembly



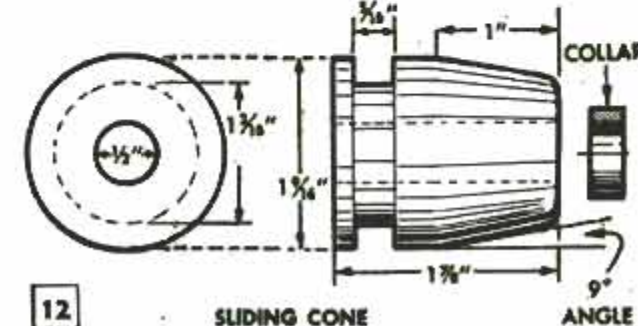
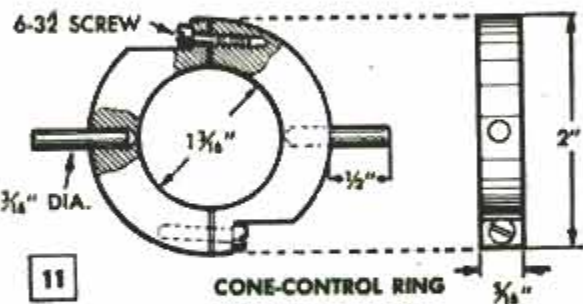
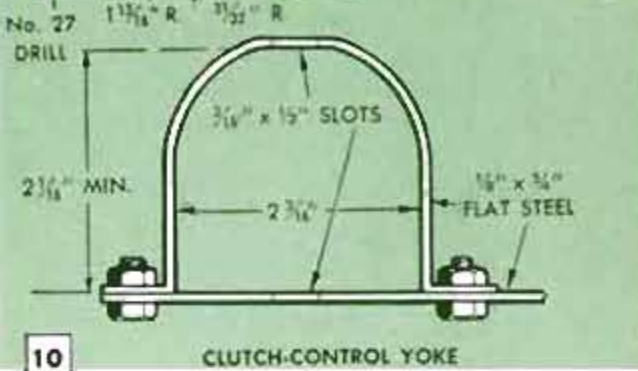
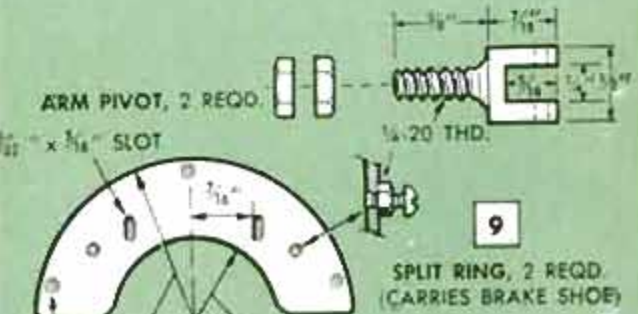
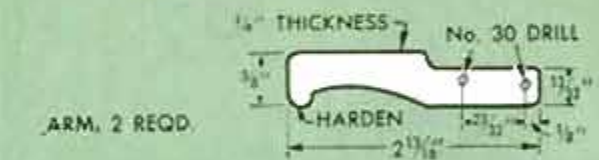
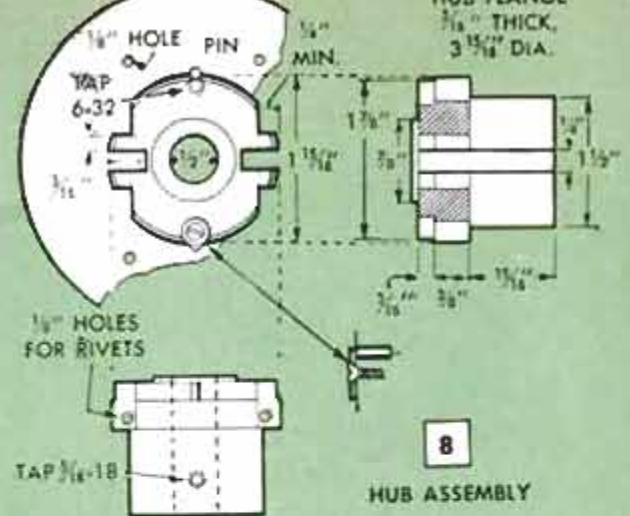




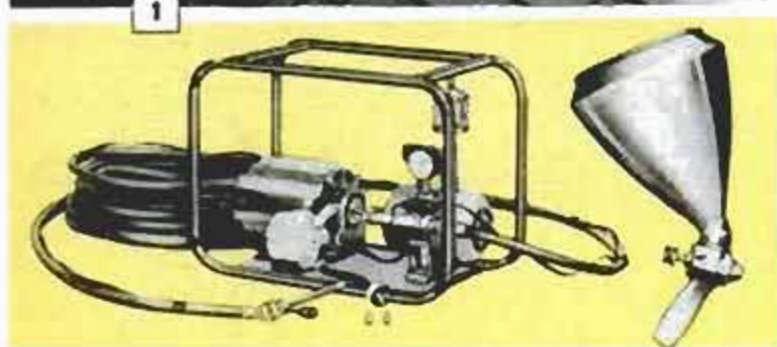
(shoe and split ring, D) is riveted to the hub flange, the rivet ends being peened over on washers to permit each shoe free movement in and out as the clutch is engaged and released.

The hub, Figs. 6 and 8, can be made by turning to outside dimensions and then filing in the grooves, but it is best to have it milled to final shape. Note that the hub is shouldered at the big end to take the flange. The latter is pinned (with two round pins) to the hub. The pins are held in place with screws and retaining washers as in the detail, Fig. 6. Main parts of the clutch mechanism are detailed in Figs. 8 to 12 inclusive. The base, Fig. 6, is dimensioned as 7 x 11 in., but its general construction and the height of the riser blocks will depend to some extent on the application.

In an assembly of this type some hand fitting will be necessary. As an example, note in Figs. 6 and 9 that the arm pivots are fitted with locknuts for adjustment. This adjustment usually can be determined with fair accuracy when the brake-shoe unit has been assembled to the stage pictured in Fig. 4. The control ring, Figs. 6 and 11, should be hand-fitted as it is necessary that it be shimmed to just the right amount of clearance. If the ring is fitted loosely, it may tend to bind. Although not detailed, it's a good idea to provide small oilholes in the hub of the pulley A, the clutch hub and also in the control ring. A drop or two of oil placed in the oilholes occasionally will cause the clutch to operate somewhat more smoothly and, equally important, will help to reduce wear on the parts when the work requires frequent starting and stopping with comparatively long idling periods. As pictured, the clutch operated smoothly at speeds up to 500 r.p.m. Higher speeds are not advisable.



SHOPPING FOR TOOLS



1. SPRAY GUN is especially designed for application of new roof coatings. Tank, or hopper, holds 2 gal. of material which gives a coverage of 150 to 200 sq. ft. of roof area. Hopper is attached to gun at an angle so that unit can be held in comfortable operating position. Interchangeable orifices are available
QUIKspray, Inc., P. O. Box 327, Port Clinton, Ohio

2. DYE PENETRANT is now available in nonflammable and high flash-point formulas in pressurized containers for convenient application. Reveals cracks, seams and degree of porosity in almost any solid material. Used to test machine parts assembled or disassembled. Penetrant is also available in bulk
Magnaflex Corp., 7300 Lawrence Ave., Chicago 31

3. HOLE SAW cuts clean, round holes 2 $\frac{3}{4}$ in. deep through wooden floors and partitions for installing pipe. Saws a hole 3 $\frac{1}{2}$ in. in diameter, has $\frac{1}{2}$ -in. dia. shank for use with $\frac{1}{2}$ -in. portable electric drills. Large knockout slots permit removal of waste after sawing through. Teeth have wide set for clearance
H. M. Starbuck & Sons, Inc.,
P. O. Box 1318, Hartford 1, Conn.

4. RADIAL SAW UNIT utilizes two radial saw heads and a specially designed power feed to do multiple ripping, tongue and groove and molding operations and various combinations of these operations in one pass through the machine. Opens new fields in production for small commercial woodworking shops
Inckwell Mfg. Co., Delta Power Tool Div.,
400 N. Lexington Ave., Pittsburgh 8, Pa.

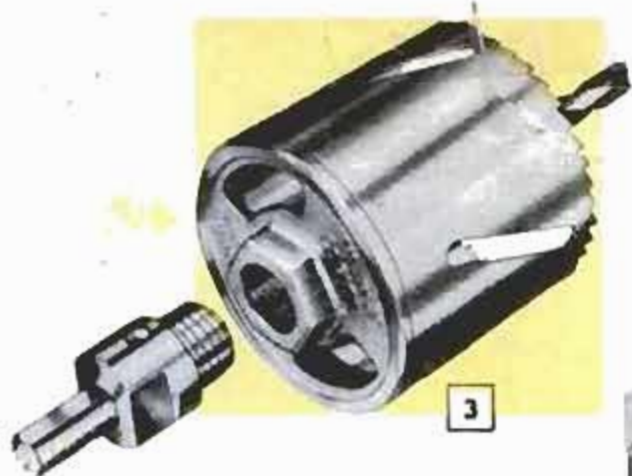
5. ROOF-FRAMING CALCULATOR does all the calculations necessary in laying out the average pitched roof. Determines lengths and plumb and level or side cuts for common rafters, hip and valley rafters, gable cripples and jack rafters, collar beams, sheathing
Gordon L. Joseph & Associates, Q & C Bldg.,
New Orleans 12, La.

6. DRILL-PRESS VISE is made for heavy work. Width of jaws is 4 in. and depth 2 in. Base size over-all is 6 $\frac{1}{4}$ x 11 $\frac{1}{8}$ in. Weighs 18 lb. Four bolt lugs, two on each side of base, permit the vise to be bolted to drill-press table or to the milling machine table
Alva Allen Industries, 1001-15 N. 3rd St. Clinton, Mo.

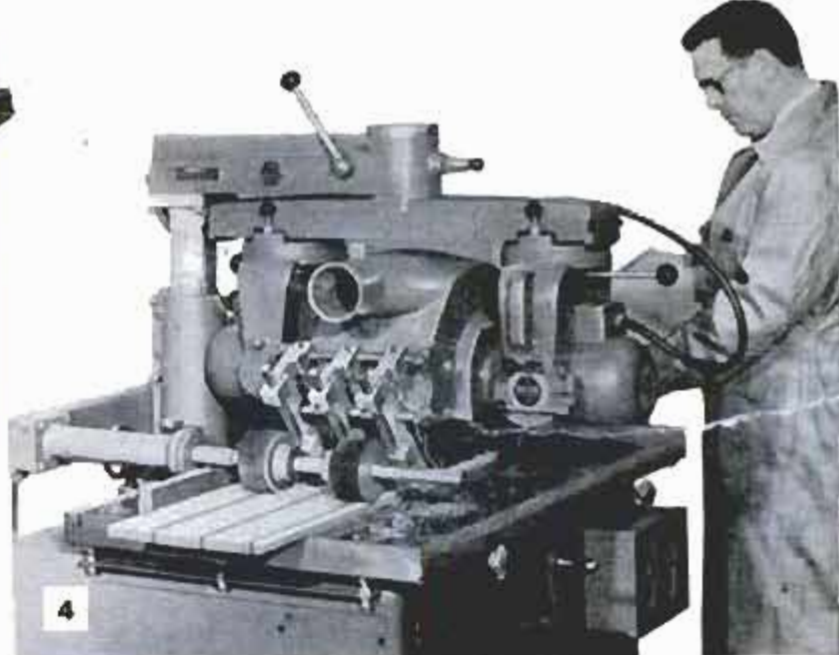
7. SNUBBER, or lock, holds rope up to $\frac{3}{8}$ in. in diameter at any point after the load is hoisted to desired height. Just swing the taut rope slightly outward to lock. Release with a straight downward pull. Holds weight up to 750 lb. Weighs only 9 oz.
McManus Mfg. Co., 7543 Santa Monica Blvd.,
Los Angeles 40, Calif.

8. POWER SCREWDRIVER ATTACHMENT for portable drills has an industrial-type clutch that will not slip when driving large screws in hardwood. Clutch disengages automatically when screw is driven home. Special holder prevents bit slipping out of screw slot
Arrow Metal Products Co., 421 W. 203 St., New York City 34

9. MITER TRIMMER cuts with a shearing action that produces a glass-smooth surface on miters and square cuts across the grain of both hard and soft woods. Hand lever operates a rack-and-pinion gear which actuates the cutters and gives a positive control
Dosh Mfg. Co., Thornton, Delaware Co., Pa.



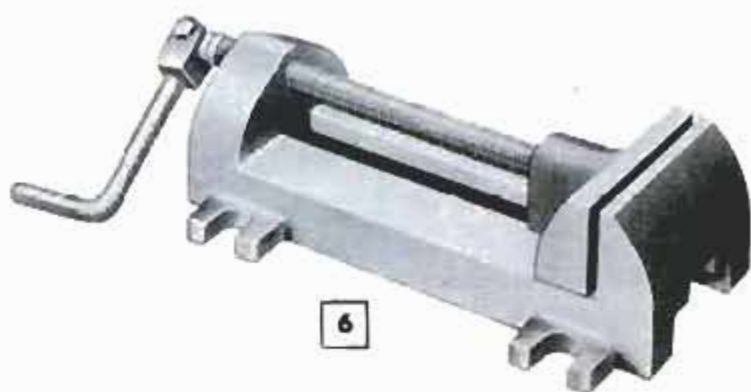
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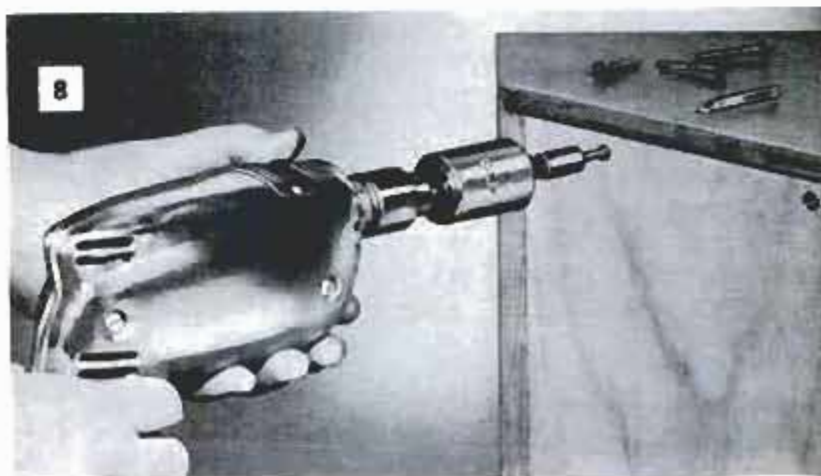
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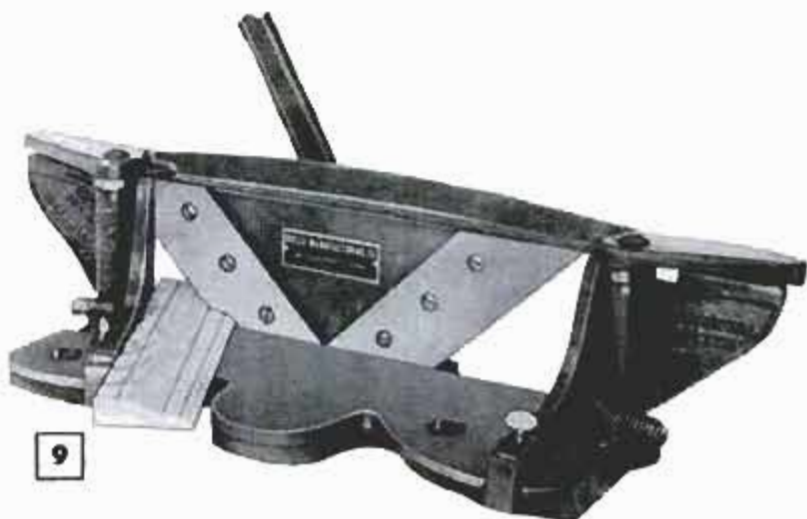
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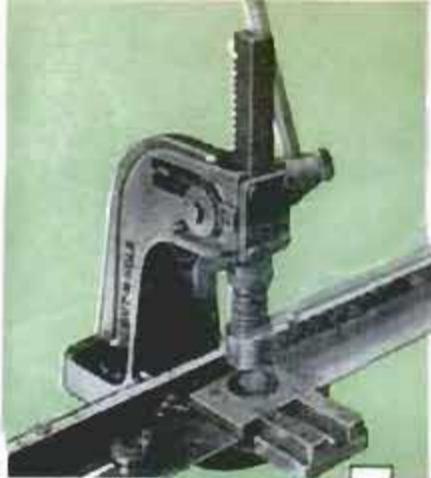


10. SHEET-METAL FASTENING MACHINE forms a rigid button-and-slot lock joint in sheet metal up to 18-ga. Each fastening is made with a single stroke of the control lever. Machine operates like an arbor press. Can be bolted in any position for feeding work and adjusting for spacing, edge alignment
Bar-Brook Mfg. Co., Inc., 6135 Linwood Ave., Shreveport, La.

11. PANCAKE MOTOR for space-cramped applications on machines, fans and similar equipment, takes about 60 percent less space than standard motors of equal power output. Motor is designed for flange mounting and for normal operating conditions is built in open dripproof type. Enclosed types available
The Louis Allis Co., 427 E. Stewart Ave., Milwaukee 1, Wis.

12. CLEANERS for cutting-torch tips are made 2 3/4 in. long to go all the way through the tip for a quick, thorough cleaning job. A complete set of 12 covers sizes 48 to 75 inclusive. Set comes in a plastic container of sufficient rigidity to prevent its being crushed when carried in toolkit or stored in a drawer
Easy Tip, Box 689, Columbia, Mo.

13. SANDING BLOCK is available with tungsten-carbide inserts that cut fast with light pressure, won't wear down when used on any surface on which ordinary sandpaper is normally used. Abrasive surface of the fine and coarse inserts is easily cleaned with a paint solvent or a wire brush. Block is of birch
Major Products Co., 17342 Kvergreen Rd., Detroit 19



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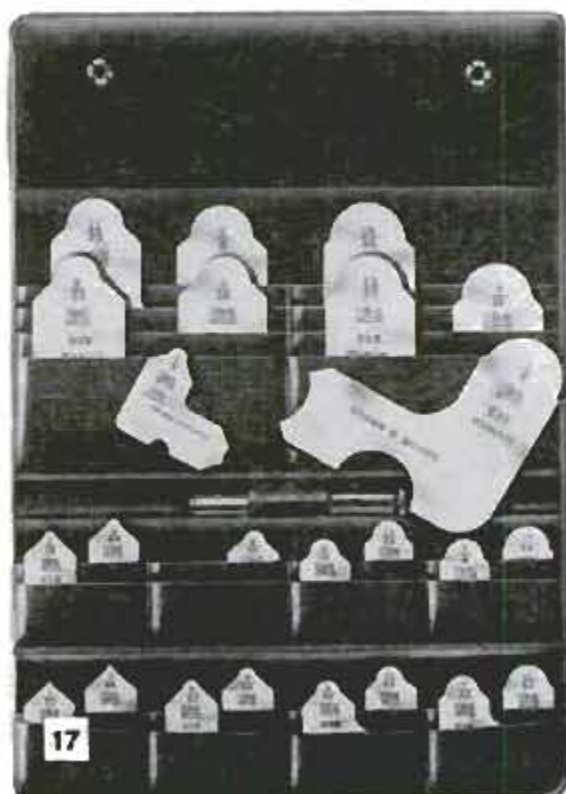
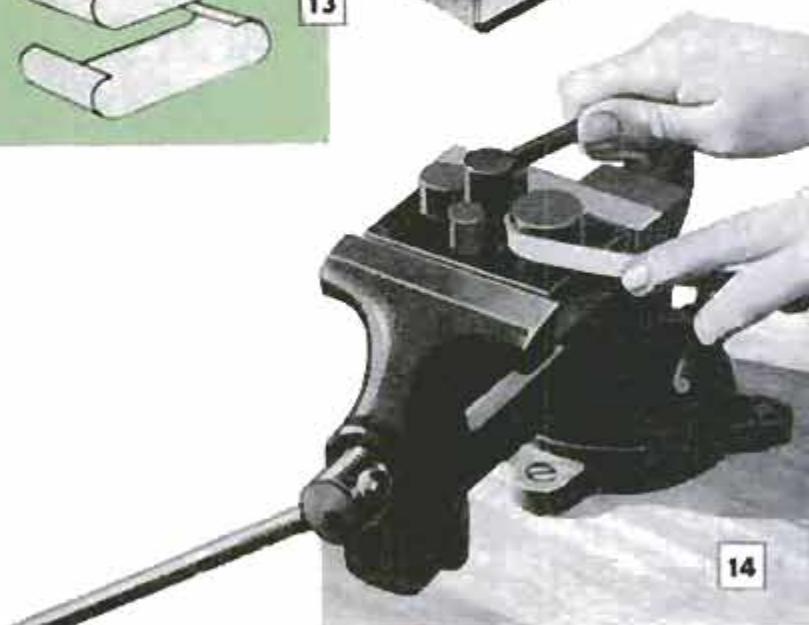
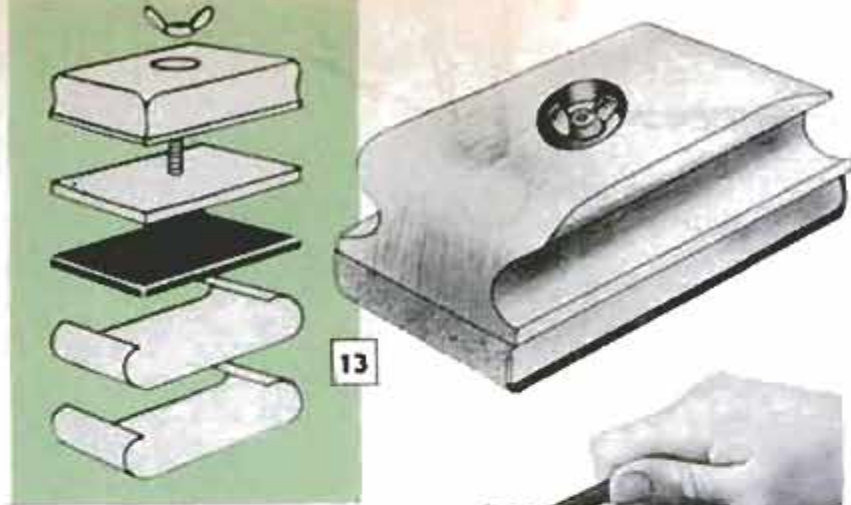
14. METAL BENDER takes flat steel and wrought iron from 1/16 to 3/32 in. thickness and from 1/4 to 1/2 in. wide. Consists of a flat-steel base, which is locked in the bench vise, on which are mounted four fixed mandrels of varying radii for controlled bending
Chas. W. Barnes Co., 31630 Lake Rd., Bay Village, Ohio

15. PAIL HOLDER will be appreciated by painters and window washers when working from a ladder. Locks solidly onto right or left ladder rail. Holds the pail firmly within easy reach. Adjusts to ladder angle to keep pail level and prevent spilling contents
Lockhart Mfg. Corp., 6350 E. Davidson St., Detroit, Mich.

16. PAINT MIXER for portable electric drills and hand drills operates on a new principle to bring paint to brushing consistency quickly without spattering. Secret of thorough, fast mixing of paint is in the manner in which mixer circulates liquid and pigments
Gunver Mfg. Co. Manchester, Conn.

17. INDIVIDUAL RADIUS GAUGES are made from stainless steel, each one having five gauging edges for testing both convex and concave radii. Available in three sets, one 1/32 to 17/64 in. by 64ths; one 9/32 to 1/2 in. by 32nds and a set combining both ranges
Brown & Sharpe Mfg. Co., Providence, R. I.

18. ROTARY PLANER HEAD does speedy, accurate surfacing of hard and soft woods when mounted in drill press and driven at speeds up to 5000 r.p.m. Specially designed cutters eliminate danger of kick-back. Widely used in woodworking and pattern shops
Kint-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio



Cutting Edges of Bit Modified to Produce Broken Brass Chips



To avoid producing brass-drilling chips in sharp, brittle ribbon form that frequently cause painful cuts when handled, one home craftsman modified the cutting edges on the bits used for drilling such material as shown in the details. All such work should be done on a fine-grit grinding wheel, as when sharpening a drill bit. To do this, first grind the cutting surface on the bit point to the desired angle for brass drilling (usually a wider angle than when it is used for drilling steel) and then carefully grind a new cutting edge on each side to a zero or slightly less than zero rake. This means that the angle formed by the new cutting edge and the surface of the bit point will approximate 90 deg. Be sure not to grind away more than half of the land width to assure accurate hole size.

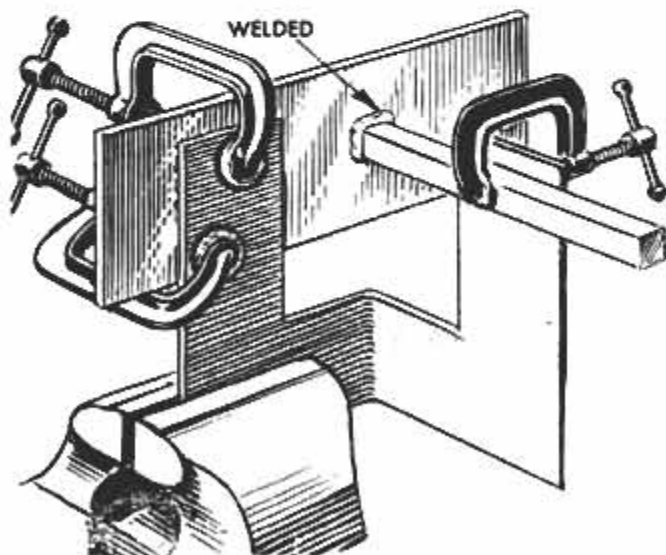
Broken Hacksaw Blade Repaired Temporarily to Finish Job



If you break a hacksaw blade half-way through a job, and another one is not available, the broken blade can be "patched together" to permit completing the work. Shorten the hacksaw frame enough to allow the broken pieces of the blade to overlap about $\frac{1}{2}$ in. and clamp them together with a C-clamp. In case a clamp is not available, use a couple of $\frac{1}{4}$ -in. nuts and bolts. The edges of the bolt heads and the nuts are clamped over the edges of the blade sections by drawing them up tight. One nut and bolt is used on the lower edge, and one on the upper edge of the blade. When cutting with the clamped blade, take short strokes to avoid striking the doubled portion of the blade against the work.

Fred Haitz, Sioux City, Iowa.

Jig Mounted in Vise Facilitates Welding Work at Desired Angle



This welding jig provides an easy way of holding pieces of work that are to be welded at right angles to one another. To make the jig, cut out a square from one side of a piece of heavy-gauge sheet metal and bend the two legs formed by the cutout so that they are at right angles to each other. The jig then is placed in a vise and the workpieces are positioned and held on the legs with C-clamps as shown in the drawing at left. Also, the legs of the jig can be bent to form many other angles and positions to facilitate welding pieces of a job at the exact angle or location required by the design.

Albert Ujcic, Mexico City, Mexico.

Radio Television Electronics



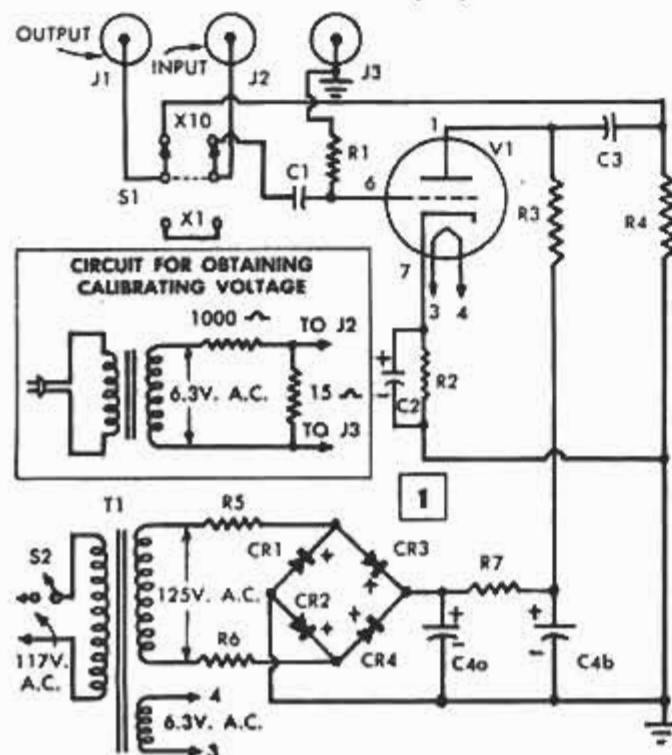
Simple Accessories Provide

MORE WORK FOR THE VTVM

By Otto Fried

MODERN ELECTRONICS is a complicated business. The electronics technician working in a well-equipped shop may have access to a dozen different test instruments to help him in his everyday

Schematic wiring diagram of VTVM preamplifier. Unit increases VTVM sensitivity by a factor of 10



work. The home experimenter or hobbyist, however, is often limited only to a vacuum-tube volt-ohmmeter, VTVM for short, with which to check or repair electronic circuits. Yet, with a few easy-to-build accessories and simple modifications, the VTVM can handle a variety of jobs normally calling for the use of separate test instruments.

One of these jobs is the measurement of extremely small a.c. voltages. While most modern VTVMs provide accurate indications for signals as low as 100 millivolts (.1 volt), below this value the needle-swing is too small for any degree of accuracy. In high-fidelity work, where voltages on the order of a few millivolts are often encountered, the VTVM needs a little help.

LIST OF MATERIALS FOR PREAMPLIFIER

RESISTORS (all $\frac{1}{2}$ -watt $\pm 10\%$): R1=2.2 meg-ohms; R2=4700; R3=27,000; R4=270,000; R5, R6=47; R7=47,000.

CAPACITORS: C1=.05 mfd./400-v.; C2=10 mfd./10-v. electrolytic; C3=.1 mfd./200-v.; C4a, C4b=80-40 mfd./150-v electrolytic.

MISCELLANEOUS: V1=6C4 tube; CR1, CR2, CR3, CR4=sel. rectifier, 150-v./20ma.; S1=d.p.d.t. switch; S2=s.p.s.t. switch; J1, J2, J3=binding post; T1=power transformer, sec. windings—125v./15ma. and 6.3v./6a.; chassis or case, $6\frac{1}{4} \times 3\frac{3}{4} \times 2$ in.; assorted screws, nuts, terminal strips; line cord.



2

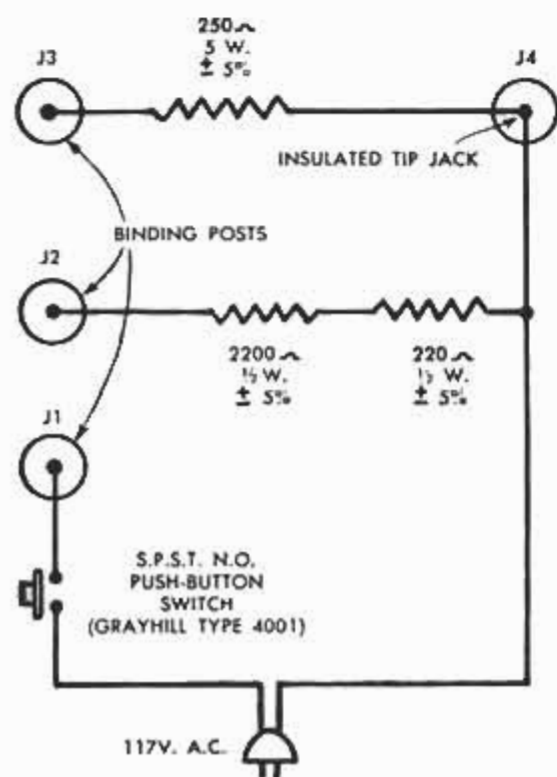
Preamplifier is connected between signal source and VTVOM. Signal is measured with separate test leads

Fig. 1 shows the schematic diagram of a simple preamplifier which increases VTVOM sensitivity by a factor of 10. Its use permits voltage measurements from magnetic phono cartridges, tape heads or low-level generators whose signals are too small to activate the normal VTVOM meter movement.

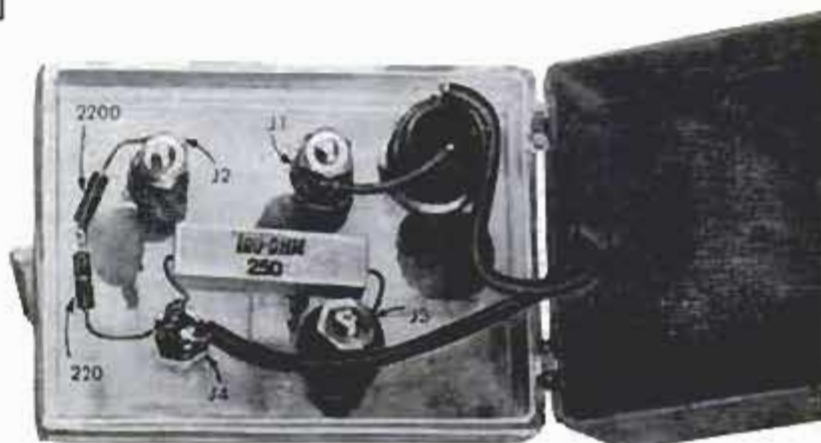
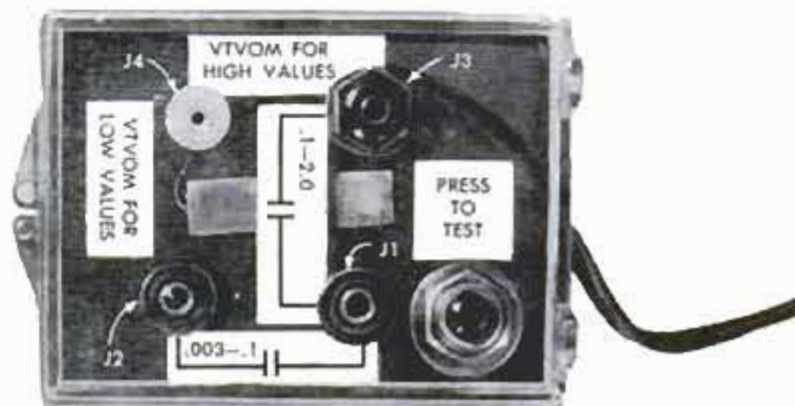
The circuit is that of a conventional r-c coupled amplifier having a high input resistance and a flat frequency response over the entire audio range. A bridge-type rectifier employed in the power supply permits the use of an inexpensive power transformer and reduces power-supply ripple to a minimum. Switch S1 is a feed-through switch which permits the preamplifier to remain connected between the VTVOM and the signal under test even for normal voltage measurements. With this switch in the X1 position, any signal applied to input jack J1 is transferred directly to output jack J3 without being amplified. With the switch in the X10 position, the preamplifier

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Schematic diagram and photographs of simple capacitor checker. Bottom photo shows wiring simplicity



3



NOTE: UNIT SHOULD BE HOUSED IN A PLASTIC BOX

TABLE I

CAPACITY	VTVOM PROBE CONNECTIONS	VOLTAGE READING
1.5 mfd.	J3—J4	15 VAC
1.0 mfd.	J3—J4	10 VAC
.5 mfd.	J3—J4	5 VAC
.25 mfd.	J3—J4	2.5 VAC
.1 mfd.	J3—J4	1.0 VAC
.05 mfd.	J2—J4	5.0 VAC
.01 mfd.	J2—J4	1.0 VAC
.005 mfd.	J2—J4	.5 VAC
.003 mfd.	J2—J4	.3 VAC
.0003 mfd.	J2—J4	.03 VAC

provides an amplification factor of 10.

The small amount of power required for the preamplifier may be obtained directly from the power supply of the VTVOM, if the latter contains a well-filtered source of B+ between 70 and 120 volts. The preamplifier could then be installed as a permanent part of the VTVOM and its construction cost would be cut by more than 50% due to the elimination of a separate power supply. If the VTVOM power supply is not well filtered, a portion of the preamplifier's filter section, R7 and C4b, should be retained. R7 should be connected to the cathode of the VTVOM rectifier and its value should be reduced to approximately 10,000 ohms.

With the parts values indicated, an accuracy of better than 10% can be expected. For greater accuracy, resistor R2 should be replaced with a 10,000 ohm, linear-taper potentiometer, connected as a rheostat, so that the circuit can be accurately calibrated.

A low-voltage calibrating signal can be obtained from a voltage divider connected across the 6.3-v. filament winding of the power transformer, as shown in Fig. 1. With the VTVOM and preamplifier set up as in Fig. 2, measure the voltage across the 15-ohm resistor with the preamplifier switch, S1, in X1 position. Then, with S1 in the X10 position, adjust the calibrating potentiometer until the same test voltage provides a meter reading of 10 times the original value.

The setup in Fig. 2 is used for all a.c.-voltage measurements. The preamplifier switch, S1, should be set to the X10 position only when the voltage under test is too small to be measured accurately on the lowest VTVOM scale without preamplification.

About two dollars' worth of parts, most of which are probably available from your "junk box," is all that is needed to convert your VTVOM into a direct-reading capacity meter. With this simple accessory, see Fig. 3, you can measure the values of all nonelectrolytic capacitors between .003 and 2 mfd. When the VTVOM is used in conjunction with the previously described preamplifier, values as low as .0003 mfd. can be accurately measured.

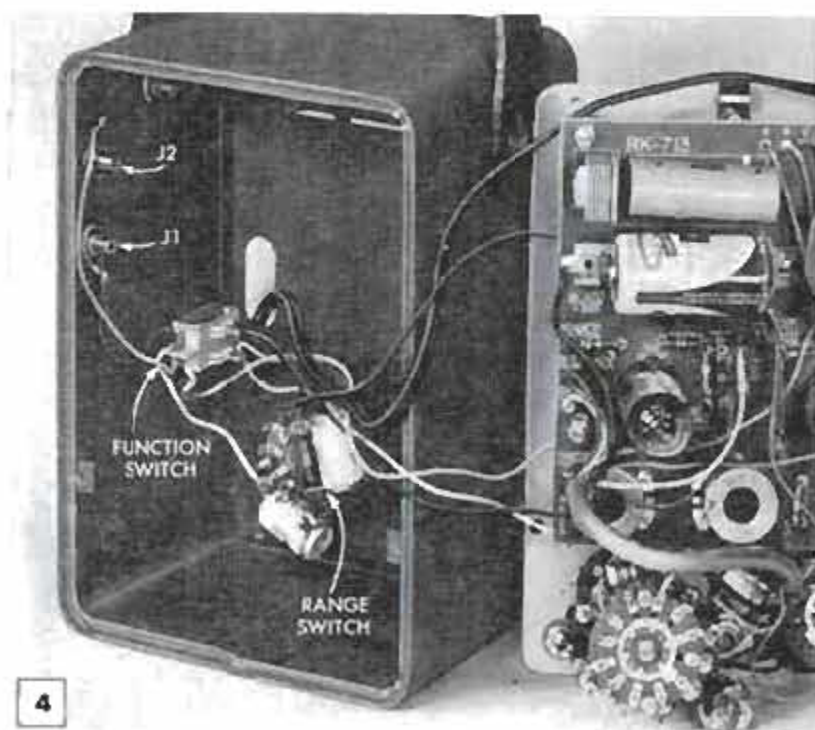
The operation of the capacitor checker is simple. The unknown capacitor and a series resistor form a voltage divider across the 117-volt a.c. line. Compared to the capacitive reactance, the resistance value is so low that it contributes almost nothing to the total circuit impedance. The current in the circuit, therefore, depends entirely on the value of capacitive reactance.

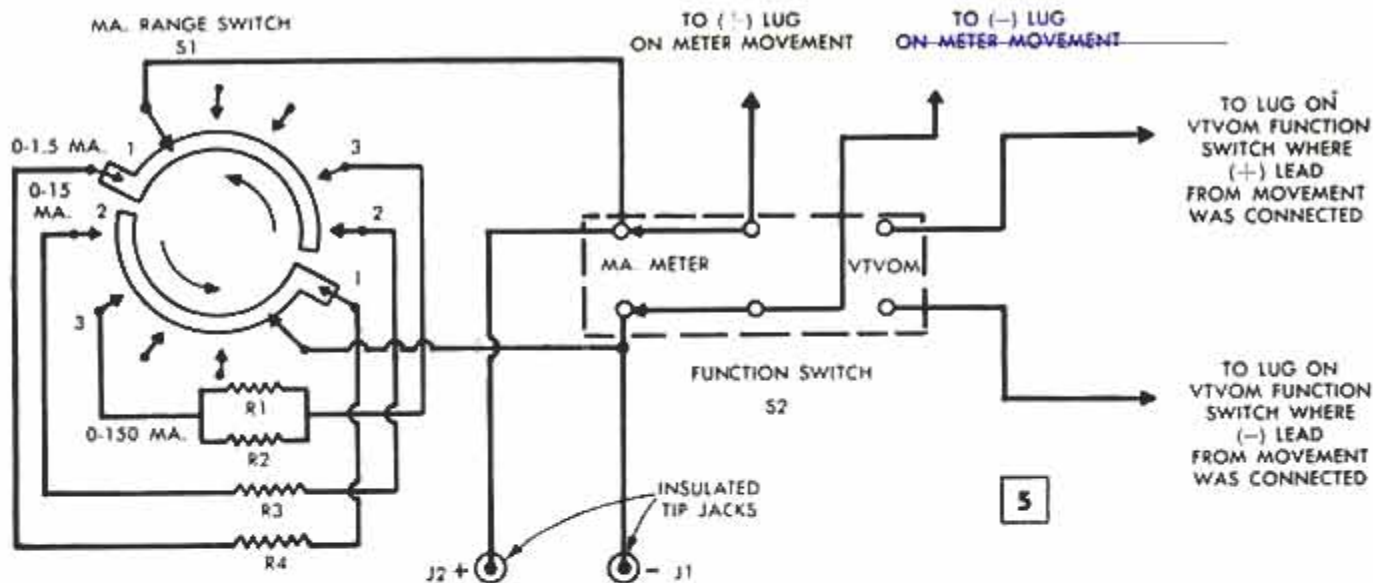
Current-flow through the resistor, however, does produce an a.c. voltage drop across this unit which can easily be calculated and measured with the VTVOM.

In actual use, small capacitors ranging from .0003 (if the preamplifier is employed) to .1 mfd. are connected between jack J1 and J2, and the a.c. voltage is measured between J2 and J4. Larger capacitors, from .1 to 2 mfd., are connected between J1 and J3 and voltages are measured between J3 and J4. The relationship between typical capacitor values and VTVOM readings are shown in table 1.

To eliminate any possibility of shock, a normally open, push-button switch, S1, is inserted between the a.c. line and J1.

A few additional parts will permit any VTVOM to measure d.c. Parts can usually be mounted inside VTVOM case as shown below





Schematic diagram shows simple wiring, parts requirements for adding current-measuring function to VTVOM

LIST OF MATERIALS FOR MA. FUNCTION

S1=2 pole-5 position rotary switch, (shorting type); S2=d.p.d.t. toggle switch; R1=2.2 ohms, $\frac{1}{2}$ -watt; R2=5.1 ohms, $\frac{1}{2}$ -watt; R3=15 ohms, $\frac{1}{2}$ -watt; R4=150 ohms, $\frac{1}{2}$ -watt; J1, J2=insulated-tip jacks

time-consuming for ordinary servicing or design work. Now, however, current measurements are routine procedures in many instances involving transistor circuits. With a few simple wiring changes and additions, and some easy calculations, you can modify your VTVOM to add this useful function to its range of operation.

For current measurements, a couple of

(Continued to page 256)

Unless this switch is pressed and held down, no voltage is applied to the binding posts. As a second precaution, all parts should be mounted in a plastic or wooden box, as illustrated in Fig. 3.

WARNING: Capacitors above .1 mfd. often retain a charge for a considerable length of time. It is a good idea to discharge them, by shorting their pigtail leads, after each test.

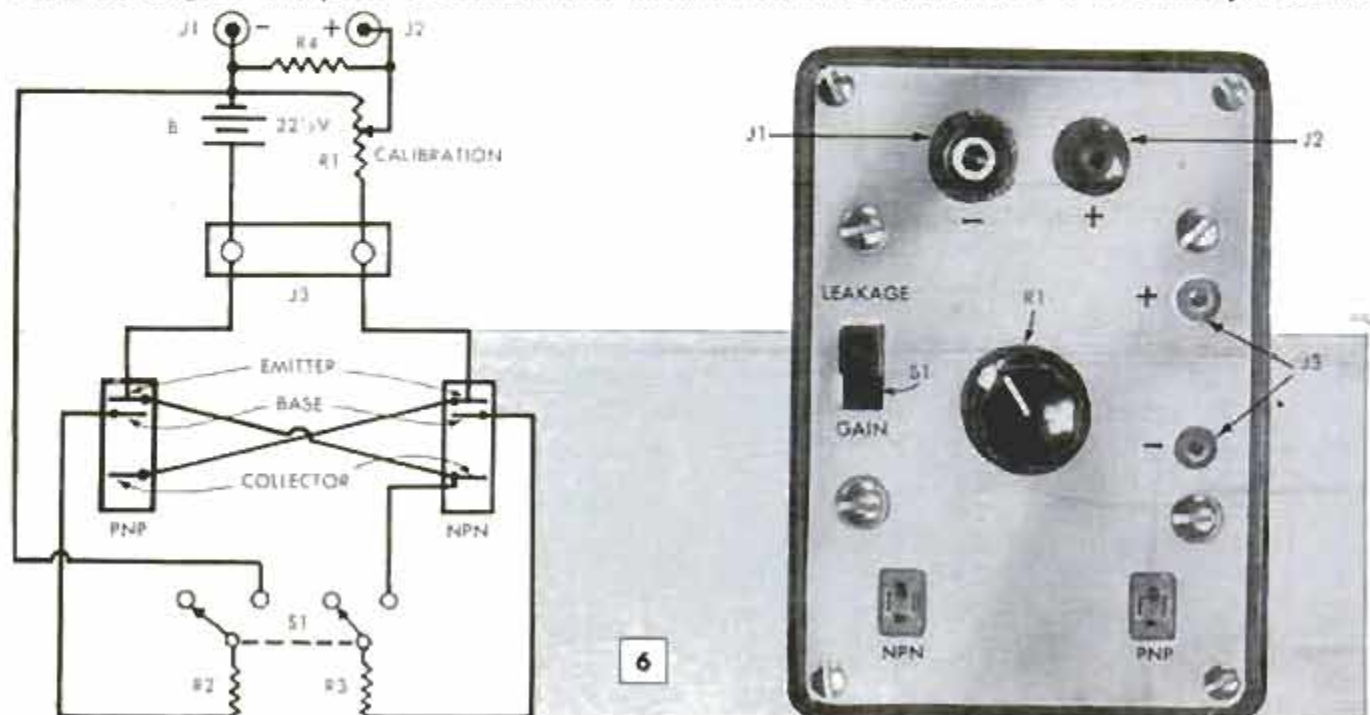
Adding a D.C. Milliampere Function

Until the invention of the transistor, d.c. measurements were considered much too

LIST OF MATERIALS FOR SEMICONDUCTOR CHECKER

R1=10,000 ohm potentiometer; R2, R3=220K, $\frac{1}{2}$ -w.; R4=1500 ohms, $\frac{1}{2}$ -w.; J1=insulated binding post; J2=insulated pin jack; J3=double phone jack; S1=d.p.d.t. spring-return slide switch; Stackpole SS-6; B=22 $\frac{1}{2}$ -v. battery, Burgess U-15; transistor sockets (2); knob for pot.; plastic case, 3 x 4 x 1 $\frac{1}{2}$ -in.; aluminum panel, 3 x 4-in.; battery holder; assorted nuts, screws and hookup wire

Schematic diagram and photo of semiconductor checker. Parts can be housed in 3 x 4 x 1 $\frac{1}{2}$ -in. plastic case





Hydroplane racing proves that engines do their *best* with Champion spark plugs. The last 13 Gold Cup winners have been powered by Champions.

Q. Why do 9 out of 10 powerboat winners use Champion spark plugs?

A. These experts know spark plugs can win or lose a race. And Champions deliver the full-firing spark they need to win. For performance like this in your car, insist on Champions.



CHAMPION

World's favorite spark plug—engineered for every car built by Ford, General Motors, Chrysler, American Motors, Studebaker-Packard and every major foreign maker

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Cleaning White Tile

Q—The ceramic-tile floor in my bathroom is discolored after many years of use. Dirt seems to be embedded in the surface of both tile and joints and scrubbing with a strong cleaning solution appears to have little, if any, effect on it. I tried rubbing with the fine side of an oilstone and the results were mildly en-

couraging but the method too slow. Is there any other way? — T. L., Fla.

A—There are several methods of cleaning tile, but where the tile are old and have seen a lot of service some of these methods do not always prove satisfactory. One method that is quite generally reliable is to make a paste, about the consistency of thick cream, by mixing white portland cement and water. Spread this mixture on the tile with a brush or cloth, allow to stand for a few minutes and then rub with a coarse cloth or a piece of burlap. When the cement film thickens, dip the cloth in water and continue rubbing until all loose material has been picked up by the cloth. Immediately dampen a clean cloth and wipe the surface, then go over it with a dry cloth. Used in this way the cement acts both as a cleaner and as a filler which works into the worn tiles and joints and brightens the floor quite effectively.



Installing Sump Pump

Q—My plumber is to install a sump pump in my basement. He says that the sump, a large bell-end tile, should be installed with the top flush with the floor and that a tile should lead from the floor drain to the sump, a distance of about 18 in. He says this will prevent flooding of

the floor should water back from the downspouts. I do not see how. Also, he plans to install the tile with a gravel bottom rather than sealing with concrete. Why? — E. N., N. J.

A—When your plumber says he plans to install tile from the floor drain to the sump "to prevent flooding of the floor should water back from the downspouts" he probably is thinking of the possibility of the drains from the downspouts becoming clogged. If the floor drains are connected to the downspout drains (a common arrangement in older homes) then water from the downspouts

(Continued to page 252)



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would likely back into the basement should the downspout drains become clogged at some point below grade. By laying a tile from the floor drain to the sump under the floor, water that backs from the drains will be taken out by the pump before it reaches the floor level. It's a fairly common practice, especially when installing a submersible pump, to partially fill the sump with coarse gravel rather than concrete. This permits water under the floor to seep into the sump. Your plumber undoubtedly has this in mind when he recommends installing the sump in this way.



Applying Gold Leaf

Q—How does one apply gold leaf, such as is so often seen on old picture frames and other ornamental objects? I'd like to learn the procedure and I have several old picture frames to practice on. These are small and quite plain, and two have liners which have apparently been coated with gold paint. Can you

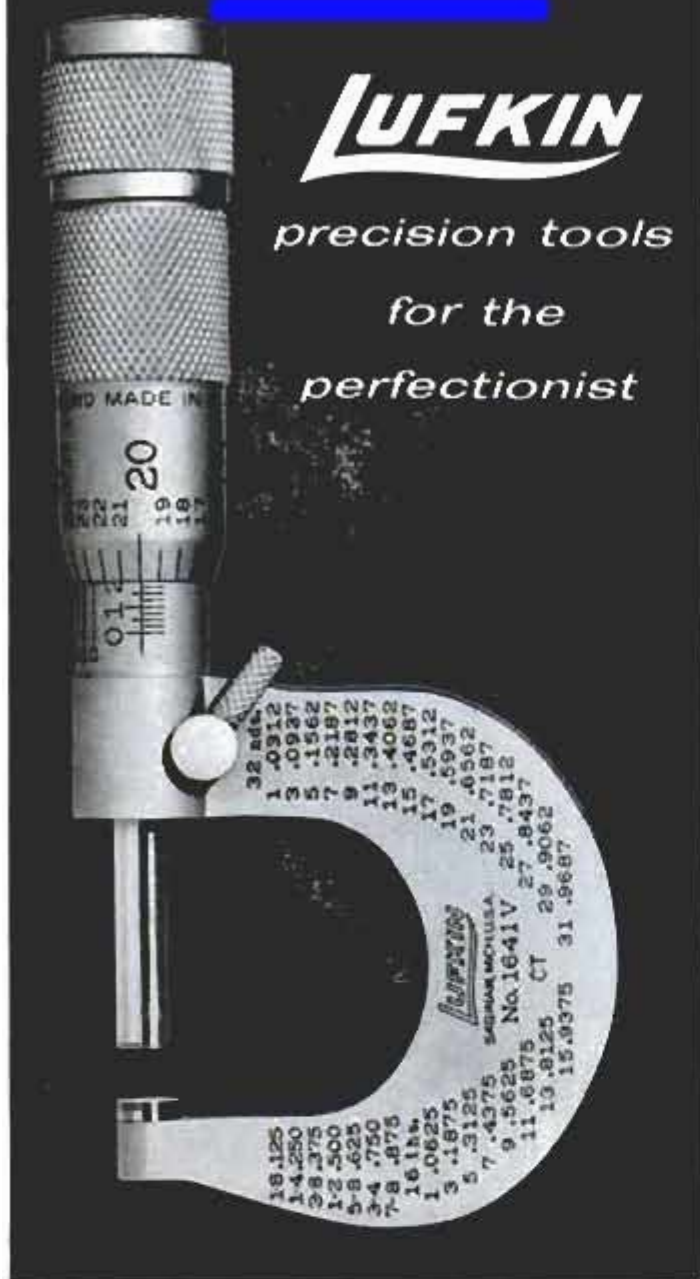
outline a proper procedure for me? — E. C., Vt.

A—We hesitate to recommend that you attempt to apply gold leaf, not that it is a difficult process, but rather that it requires such close attention to detail that results of one's first efforts are likely to be disappointing. Space will not permit a complete outline of the methods of gilding with gold leaf, but if you are determined to learn the general procedure then perhaps the following suggestions will be of help to you. Preparation of the surface has everything to do with the success of the job. Clean off paint (with remover) and grime to the bare wood. Sand smooth. Then coat the surfaces to be gilded with a mixture of glue and whiting. When this is dry, sand smooth and finish with very fine steel wool to a glass-smooth surface. Coat the surface with a prepared gold size and allow to stand until the size becomes rather stiffly tacky. Gold leaf comes in a "book" containing a number of gold leaves placed between specially prepared sheets of paper to which it will not adhere readily. Don't attempt to pick up the leaf with your fingers. Cut it into small pieces with a razor blade by placing the edge on the leaf and pressing down lightly. Gilders use a special brush, usually referred to as a tip, to pick up gold leaf, but a clean camel's-hair brush is a fairly good substitute. Stroke the brush briskly on a piece of fabric, place the bristles over the piece of leaf, lift it and then tip it onto the area which has been sized. If the size has been allowed to reach the correct degree of tackiness the leaf will adhere readily. Immediately place a piece of waxed paper over the applied leaf and press it very lightly into contact. Repeat the process, tipping the second leaf onto the sized surface so that one edge slightly overlaps that previously applied. Portions of the leaf that overlap the sized area can be removed by brushing lightly.

Finishing Log Siding

Q—I plan to build a summer home to be finished on the outside with precut log siding. I want to preserve the natural color of the siding; don't want it to turn dark on exposure to weathering like some other log-siding jobs I've seen. Also, want to treat the wood to prevent damage by insects. What do I use?—O. W., Minn.

A—If you have visualized the wood of the log siding remaining in the natural color indefinitely, you are likely to be disappointed. Even though you use a specially prepared log-siding finish, the wood itself will darken somewhat in time, due mainly to the effects of light and the variations in temperature and humidity. The wood will age slowly under any nonpigmented finish. However, the color variations intensified in this process are not at all objectionable, in fact, are quite attractive. When using a prepared finishing material be sure to follow the manufacturer's instructions in all details.



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and that gas needle *never* seems to go down!

“Then I pampered myself a little bit. Foam rubber padding in the seats (I’m a big guy and I spend *hours* at the wheel); Chevy’s new throttle-holder where you just set your cruising speed for those long straights and the car holds it while you rest your right foot; the big ‘fresh-air’ heater. Man, you should drive my car. It fits me like a glove!”

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How Good Are the Gadgets?

(Continued from page 184)

about two years to pay back the purchase price (about \$35) and there will be the annoyance of keeping the auxiliary fuel tank filled.

Automatic fan release.

The fan is needed less than five percent of the time. It uses up about ½ horsepower at 2000 revolutions per minute (engine speed) and 4 horsepower at 4000. In one test, removal of the fan boosted gas mileage by two percent at 60 miles per hour. At this rate you would have to drive 100,000 miles to get back the \$40 the fan release costs. And the improvement is even less at the more usual, slower driving speeds (greater at higher speeds). An extra benefit of the device is the tiny increase in horsepower and the reduction of fan noise, objectionable in some cars.

Oil-firing spark plugs.

The National Bureau of Standards (along with most experienced mechanics) has found that in an engine with oil-fouled spark plugs, ignition is better if there is an extra air gap in the wiring connection at the top of the spark plug. The gap may be built into the plug or just added to the top of the plug.

This is easily explained. The coil delivers energy to the plug, not instantaneously, but over a short period of time. When the plug is oil fouled, the charge may leak through the oil film as fast as it arrives and never build up a charge strong enough to jump across the electrodes and ignite the fuel mixture. With the extra air gap at the top of the plug, the charge is held up there until its voltage is enough to jump this extra gap. Then the full charge arrives instantaneously at the regular spark-plug gap inside the cylinder and fires the mixture.

The auxiliary gap should not be used all the time. In some cases the coil does not develop enough voltage to jump both gaps while the battery is cranking the engine. This would obviously prevent the engine from starting, especially under extreme conditions as in subzero temperatures.

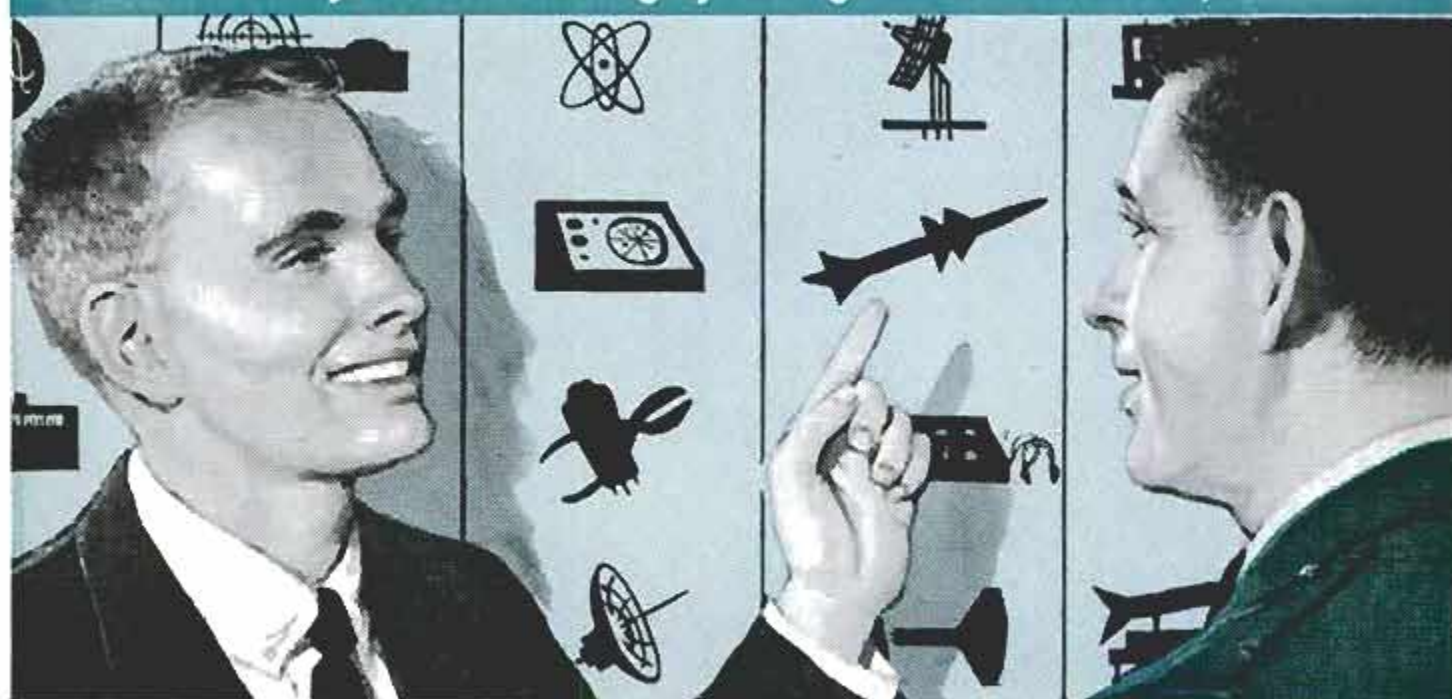
Dashboard spark control.

Cars using high-octane gasoline accelerate a little better than normal if the spark is slightly advanced. The same cars will perform fairly well on low-octane gasoline if the spark is slightly retarded. To permit the driver to make these adjustments, a spark control on the dash is convenient. It permits the driver temporarily to retard

(Continued to page 262)

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More Work for the VTVOM

(Continued from page 248)

switches and a separate pair of test-lead jacks must be added. Fig. 4 shows these additions on a Knight VTVOM kit which has been converted for this purpose. The location of the added parts is not at all critical. They can be installed any place on the panel or case where they will not interfere with the other wiring.

In order to convert your instrument, sensitivity and internal resistance of the meter movement must be known, and the calibration of the d.c. voltage scale must be taken into consideration. Meter specifications are usually printed in an instruction manual which was supplied with the VTVOM, but they can be obtained from the manufacturer if the manual is no longer on hand.

Fig. 5 shows the parts and wiring which add a ma. function and 3 ranges to any VTVOM. The original VTVOM wiring need not be disturbed, except for the two wires which connect the meter movement to the VTVOM function switch. These must be unsoldered from the switch terminals and connected to the center terminals of the added function switch, S2. Two wires connected to the terminals at one end of the new function switch are then soldered to

the VTVOM switch terminals from which the meter leads were removed. With the new function switch in the VTVOM position, the original VTVOM circuitry is restored. With S2 in the ma. position, the meter movement is connected to the ma. range switch, S1, in a typical ma-meter circuit. Shunt-resistance values given in the material list are correct for meter movements having an internal resistance of 1000 ohms and a sensitivity of 200 microamps. The current ranges are 0-1.5 ma., 0-15 ma. and 0-150 ma. for range-switch positions 1, 2 and 3, respectively. Exact values can be read on the 0-15 voltmeter scale.

Shunt resistance values for meters with other specifications and ranges can be calculated as described in the following example.

GIVEN:

Meter sensitivity=400 microamps for full-scale deflection.

Meter resistance=2000 ohms.

Lowest voltmeter scale=0-3 volts.

PROCEDURE:

Because the lowest voltmeter scale is graduated from 0-3 volts, we will settle for milliammeter ranges of 0-3, 0-30 and 0-300 ma. The correct current value can then be read directly on the 0-3 volt scale. For the 0-3 ma. range-switch position, a maximum

(Continued to page 258)

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of 3 ma. will flow through the meter and shunt. Only 400 microamps may be permitted to flow through the meter itself, with the rest of the current going through the shunt. The shunt, therefore, must carry .003-.0004=.0026 amperes of current. The shunt resistance value can be calculated by means of the formula:

$$R \text{ shunt} = \frac{R \text{ meter} \times I \text{ meter}}{I \text{ shunt}}$$

Substituting values in this formula gives
 $R \text{ shunt} = \frac{2000 \times .0004}{.0026} = 308 \text{ ohms (approximately)}$

For the 0-30 ma. range, $I \text{ shunt} = .03-.0004 = .0296 \text{ amperes.}$

Substitution in the formula gives—
 $R \text{ shunt} = \frac{2000 \times .0004}{.0296} = 27 \text{ ohms (approximately)}$

For the 0-300 ma. range, $I \text{ shunt} = .3-.0004 = .2996 \text{ amperes.}$

$R \text{ shunt} = \frac{2000 \times .0004}{.2996} = 2.7 \text{ ohms (approximately)}$

The closest commercially available, 1/2-watt resistors provide sufficient accuracy for all ordinary applications.

The newly installed test-lead jacks are employed for all current measurements. Both of these jacks must be insulated from the meter case (if the latter is made of metal) in order to eliminate any shock hazard.

When measuring current in a circuit, the VTVOM need not be turned on. Remember, however, the test leads must always be connected in series with the circuit under test. Carelessness in observing this precaution will almost certainly result in a burned-out meter movement and shunt resistor—a mistake which is likely to entail considerable expense.

Semiconductor Checker

With transistors becoming increasingly popular, there is a definite need for a simple, inexpensive device capable of indicating transistor quality. The semiconductor checker in Fig. 6, used with your VTVOM, not only checks all types of germanium transistors (not including power transistors), but can also be used to check the performance of selenium rectifiers and crystal diodes.

As shown in the schematic diagram, the unit is self-powered by a 22½-volt battery which, because of the low current requirements of the circuit, will have almost "shelf life" in actual operation.

Two transistor sockets are mounted on the front panel. These are so wired that the correct battery voltage is applied to either PNP or NPN transistors when these units are plugged into their corresponding

(Continued to page 260)

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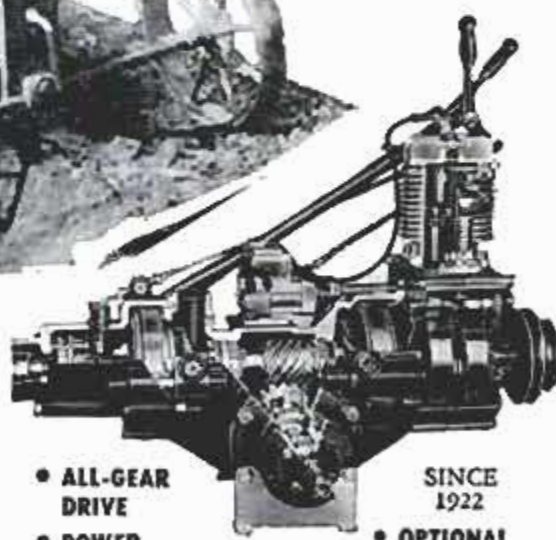
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sockets. The leakage-gain switch, S1, is a d.p.d.t., spring-return slide switch wired so that it is normally in the leakage position, as shown in the schematic. In this position, the base of a transistor plugged in the socket is open-circuited and only a relatively small leakage current will flow through the transistor. When the switch is moved to the gain position, a small bias current is applied to the base through resistor R2 or R3. Consequently, the transistor collector current increases appreciably. The ratio of gain-to-leakage current is a good indication of transistor quality.

To check transistor quality connect the d.c. probe of the VTVOM to J2 and the "common" lead to J1. Set the VTVOM range switch to the lowest voltage range (usually 1.5 volts) and plug the transistor in the correct socket. (Check catalogue description or manufacturer's literature to determine whether the transistor is an NPN or PNP unit.)

Move the gain-leakage switch, S1, to the gain position and adjust the calibration potentiometer, R1, to obtain a meter reading of 1.5 volts. Release the switch so that it returns to the leakage position and note the meter reading.

For a good quality transistor, the gain-to-leakage ratio indicated by the meter will be high. The greater this ratio, the greater is the potential current gain of the transistor.

If no meter reading is obtained with the switch in either the gain or leakage position, the transistor is open-circuited. If the leakage current equals or exceeds the gain current, the transistor is short-circuited. If the leakage current approaches the gain current, the transistor is capable of very little or no amplification.

SELECTING MATCHED PAIRS. For push-pull or complementary symmetry circuits, the transistors used should have very nearly the same characteristics. A pair of transistors is "matched" if the gain and leakage currents of both transistors are the same, or nearly the same. By checking a number of transistors, those with the closest corresponding characteristics can be selected for critical circuit applications.

CHECKING TRANSISTOR NOISE. Low-level amplifiers, such as preamplifiers, require the use of low-noise transistors. The relative noise level of a number of transistors can be compared by connecting a pair of crystal headphones to the double phone jack, J3, and adjusting the gain current of each transistor for a 1.5-volt meter reading. (A pair of magnetic headphones may be used for this purpose by connecting a .05 mfd. capacitor in series with one of its

leads.) Transistor noise will be audible in the headphones.

CHECKING RECTIFIERS AND DIODES. Rectifiers and diodes can be checked with a pair of test leads plugged into the double phone jack. This jack must be wired so that the terminal marked (+) in the photograph is connected to the positive side of the battery and the negative terminal is connected to one end of potentiometer R1. To check forward-to-reverse conduction ratio of rectifiers and diodes, connect the lead from the negative jack of the tester to the positive terminal of the rectifier or diode, and the positive test lead to the negative rectifier or diode terminal. (The positive terminal of crystal diodes is often marked with a band, a dot or a "K.")

When so connected, the rectifier or diode is forward biased and R1 can be adjusted for a 1.5-volt indication on the VTVOM. Now reverse the test-lead connections to the rectifier or diode and note the meter deflection. With good components, the reverse-current is very low so that a ratio of at least 20 to 1 is obtained. (Some high-conduction diodes, such as video detectors, are good if the forward-to-reverse current ratio is 10 to 1, or greater.)

Selenium rectifiers, in addition to having a high forward-to-reverse current ratio, must have low internal resistance when biased in the forward direction. Otherwise, they might break down under full load. To check for this possible defect, short out the test leads and adjust R1 for a meter deflection of 1.5 volts. Then, without disturbing the setting of R1, connect the negative test lead to the positive rectifier terminal, and the positive lead to the negative terminal. If the rectifier is good, the meter should read at least 1.35 volts. ★ ★ ★

Plastic Brush and Scraper Cleans Snow off Car

You can clean snow off the roof, hood and windshield of your car with a combination brush and scraper. The brush has polyethylene bristles that retain their shape indefinitely. On the back of the brush is a seven-inch blade that doubles as a scoop for heavy snow. It is also a squeegee. The scraper end has a five-inch curved row of teeth. The device can be separated in the center for storage.



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Crestwood is packaged in an easy-to-handle carton containing enough flooring (with proper nails) to cover 25 sq. ft. of floor area. Flooring strips have tongues and grooves for blind nailing, with nail positions marked on tongues for your convenience and to assure adequate nailing.

A new Bruce Crestwood Floor will cost you less than a good rug or carpet . . . and will last the life of your home. Sold by leading lumber dealers. Mail coupon below for colorful literature.

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Product of world's largest hardwood flooring maker

the spark to prevent knocking on the occasional tankful of gasoline that may have a below-average octane rating. The engine can, of course, be damaged if the driver is so foolish as to run with the spark far enough advanced to make the engine knock.

It is also possible on many cars to get a few percent more gas mileage at some spark setting other than standard, but few motorists will have the ability or inclination to make the lengthy tests required to find the correct setting.

A simple, inexpensive cable, such as used on a hand choke, will work about as well as the special controls sold for the purpose. The micrometer (so-called) adjustment on the latter has little real value.

Relay for using 12 volts on six-volt system.

At temperatures lower than 10 below zero, the starter may not be able to crank the engine fast enough to start it running (a properly winterized car with electrical equipment in good condition should start without trouble at temperatures above that). A relay, which when used with two six-volt batteries delivers 12 volts to the starter, will give a substantial increase in cranking speed on extra-cold days. However, there is some risk to the starting motor because it is not designed to operate on 12 volts. Most of the advantages can be obtained without any risk of damage by using an oversize six-volt battery or two standard six-volt batteries permanently connected in parallel (positive to positive, negative to negative). ★ ★ ★

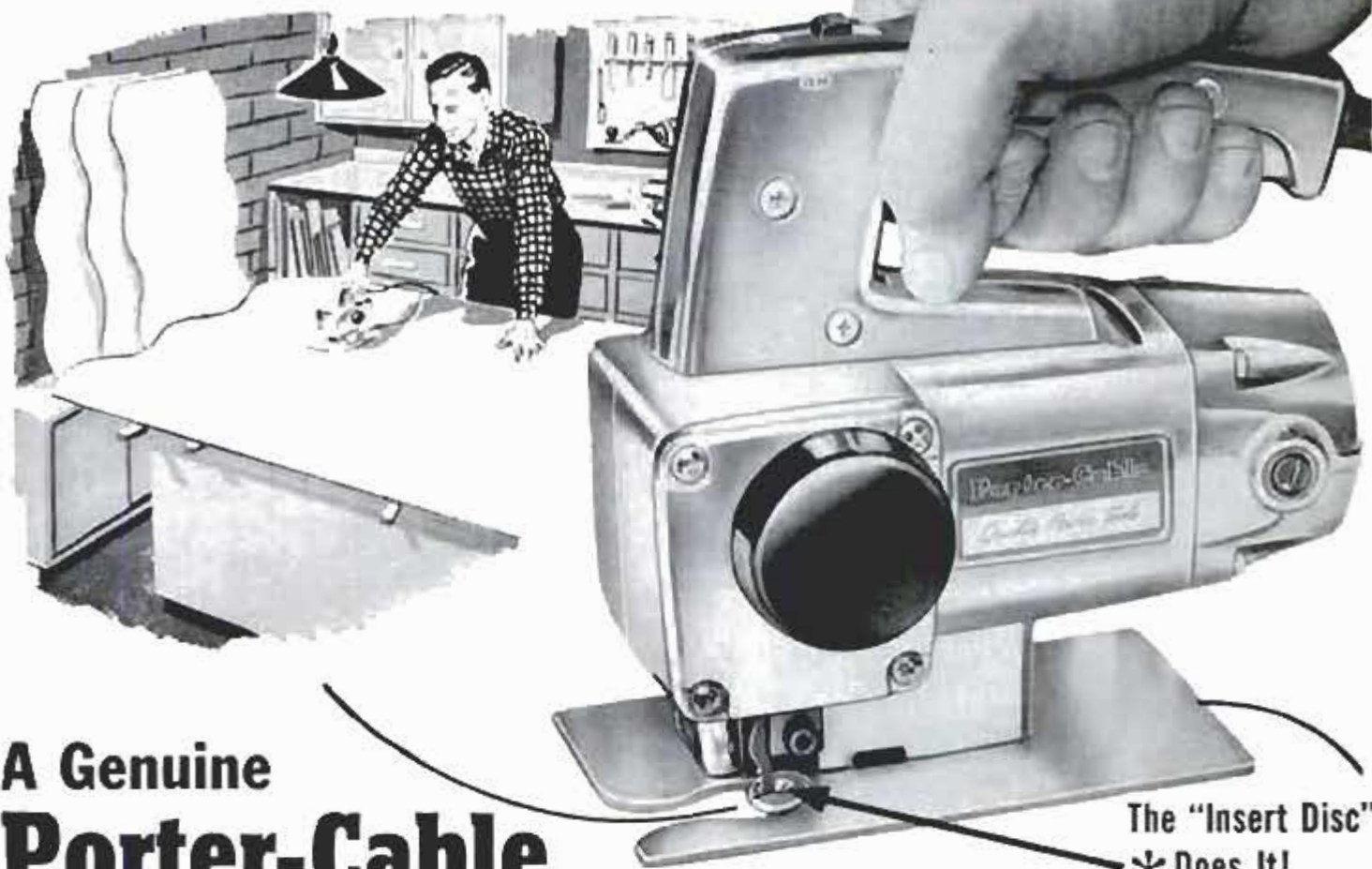
Mushrooms Grow in Three Days

Morel mushrooms, a favorite of gourmets, are grown to full commercial size in three days by a new pure vat-culture method. Common shed-grown mushrooms require about 60 days to grow to commercial size. Yorktown Products Corporation and Battelle Memorial Institute devoted 10 years of research to development of the new process of growing the mushrooms in vats of pure, aerated nutrient fluid.

Tiny Tubing Made From Quartz

Microtubing about the diameter of human hair is being produced from quartz by the Monsanto Chemical Company. The tubing is so fine that one drop of water would fill 50 feet of it. The microtubing will be used in the recovery of billions of cubic feet of helium now lost in natural gas.

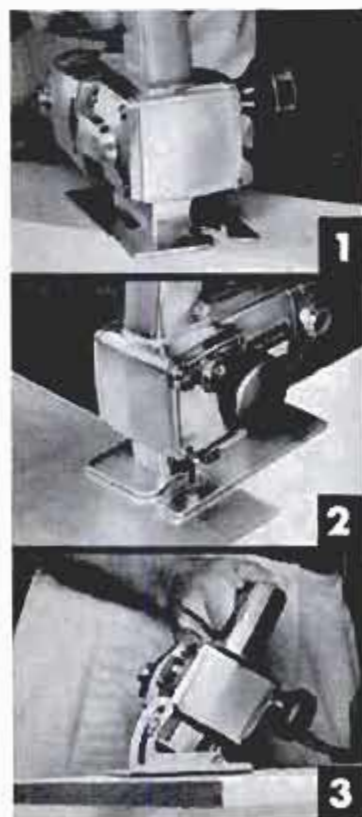
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The "Insert Disc"
*Does It!



The Porter-Cable 152 Hand Saw is the only saw with the patented insert disc which virtually eliminates chipping and insures a smooth, even cut on plywood, plastic laminates and other materials. It's the all-purpose saw for home or workshop - hack saw, scroll-saw, cross-cut saw, jig saw, keyhole saw, coping saw and rip saw.

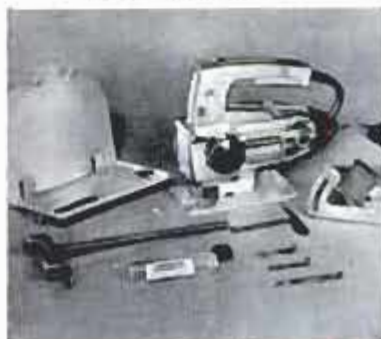
1 SLICES 2x4's in 8 SECONDS. Use it as cross-cut or rip saw. Handles full 2" dressed lumber, plywood, other materials.

2 CUTS METALS, TOO - 1/4" aluminum, 1/8" steel! Sheet metal, fittings, bar stock, and pipe are cut quickly and cleanly.

3 CUTS ANGLES...accurately! Accessory base allows precise angle cuts up to 45°. Easily and quickly adjusted.



EXCLUSIVE ORBITAL ACTION Blade moves ahead on upward stroke—backs away from work on down stroke. Eliminates drag and excess heat. Cuts 3 times faster. Blade life up to 30 times longer.



Complete with package of 3 assorted blades, patented "Insert Disc," allen wrench and tube of grease.

ONLY \$54⁹⁵

SPECIAL KIT
Saw plus handy wall bracket, angle base, rip guide, and extra blade assortment.

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Wherever boating enthusiasts see the Aluma Craft name it is instantly accepted as the mark of quality . . . the guarantee of fine design, precision construction and quality materials. Aluma Craft also means excellent performance. It stands for the speed, stability, safety, and strength that assures years and years of boating pleasure.

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Owning an Aluma Craft is practically all fun with no work. Your Aluma Craft is always ready to give you a day, a week or a season of pleasure. They are strong and sturdy, yet light and easily handled. They require little or no upkeep and are easily trailered or car-topped. Winter storage problems are mostly eliminated.

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ADDRESS _____

CITY _____ ZONE _____ STATE _____

Fusion Power for the World of Tomorrow

(Continued from page 128)

10 gallons of ordinary tap water contains enough deuterium to supply all the electrical requirements of your family for one full year. And this much fuel, even now, can be separated from the water for less than 30 cents!

Such are the stakes in this scientific game.

How do you go about fusing deuterons? Each deuteron has a positive electrical charge, so they repel each other with incredible violence. Whenever two deuterons approach, they instantly fly apart. The only way to force them together is to heat them. Then, like ants on a hot stove, they'll move so fast they'll collide blindly before they have a chance to recognize each other.

The temperature of the "stove" must be a hundred million degrees or more. At that temperature, atoms break down into free electrons and nuclei. This gaseous mixture is called a *plasma*. The electrons in the plasma will be traveling 90,000 miles per second, and the deuterons at 1500 miles per second. This is precisely what is happening in the stars of the sky.

Bottle to Hold a Star

Obviously, finding a bottle to hold a star is the toughest obstacle science has ever tackled. The melting point of the most heat-resistant of known solids is around 3000 degrees. Strange as it sounds, however, heat is not much of a problem, as there is very little actual heat in the bottle. The plasma is such a thin gas that, although individual particles are superhot, the total heat content is not very high. In fact, even when a liter of the gas reaches 350 million degrees it will hold just about enough heat to make a cup of coffee palatable!

The big problem, from the standpoint of the physicist, is *keeping* the gas hot. If the deuterons, in their wild dance, should touch the sides of the bottle, the gas would instantly be cooled to a point where fusion couldn't take place.

Since the ants on this hot griddle all have an electrical charge, they should be subject to control in a magnetic field. This is the approach that is being tried on a worldwide basis in the search for the elusive thermonukes. Anyone investigating this field is somewhat surprised to discover that there are virtually no security wraps on the research in magnetic bottles. Research papers show that scientists apparently are approaching the last difficult steps to success.

(Continued to page 266)

Perfect mating

of man and machine



CRUISING COMFORT ON A HARLEY-DAVIDSON DUO-GLIDE

Highways . . . expressways . . . country lanes . . . city streets — there's always a *smooth* road ahead when you ride a Duo-Glide. Solo or with a buddy, you travel as smooth as silk—hydraulically smooth from front fork to rear suspension.

And this glide-ride is a go-ride too. 74 cubic inches of OHV power are nestled compactly in this chrome and steel beauty. Also available in an "H" super-powered model with extra speed . . . extra stamina. Make a date to test ride the Duo-Glide at your Harley-Davidson dealer. Or use the coupon for free color folders.



1 **FRONT** — Hydraulically damped, Hydra-Glide front fork goes into action on all surfaces — takes the bumps out of rough roads, makes smooth roads even smoother.

2 **MIDDLE** — Spring-loaded seat post offers an extra measure of riding pleasure. Alone or riding double, springs give you a level ride at all times.

3 **REAR** — Husky, hydraulic shock absorbers control the amazing swinging arm. Bounce and bumps are ironed out . . . wheel actually hugs the road around curves.



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Address below.

Significant numbers of neutrons have been captured in some of the equipment. Whether they are true thermonukes, or neutrons from side reactions, has not yet been proved.

Four Approaches

So far, four different approaches to the magnetic bottle have been tried:

1. The first method takes advantage of the so-called "pinch effect." In this method, a strong magnetic field is created around the plasma, forcing it away from the sides of the bottle and into a sort of a rope. As the current is increased, the rope tends to shrink, constricting or pinching the deuterons into a narrow field where the temperature builds up and they are more likely to collide. This is the technique used in the famous Zeta machine of the British. The principal difficulty is that the plasma rope begins to writhe, creating such kinks and "sausage links" that it destroys itself. As Dr. Ruark says, "Asking the pinched current to stay quietly in the middle of the tube is something like asking a boa constrictor not to constrict." Still, ways are being found to tame the boa. One is to place a strong magnetic field down the middle of the plasma, giving it a sort of a spine or stiffener.

2. A more recent approach, under investigation at the University of California Radiation Laboratory, is a "magnetic mirror." This instrument consists of a long straight tube surrounded by coils of wire to create a field around the plasma, preventing it from reaching the sides of the tube. At each end of the tube, extra strong magnetic fields or "mirrors" reflect stray particles back, holding the plasma in an unbelievably hot ball. This creates a more stable plasma, but there is one disadvantage: Before this reaction will be self-sustaining, it may be necessary to raise the temperature of the plasma to a billion degrees or more.

Most Promising

3. One of the most promising approaches is the Stellerator at Princeton. In this technique, the tube is either doughnut-shaped or formed into a figure 8. After the plasma has been heated to about a million degrees, the deuterons are further speeded by alternating the field rapidly (called magnetic pumping).

4. An apparatus called DCX at Oak Ridge National Laboratory is basically a new means of injecting deuterium into the magnetic bottle. The deuterium atoms are shot into a static magnetic field, where a carbon arc blasts them into electrons and

(Continued to page 268)

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Look for the trademark on the handle.

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nuclei. This creates a very high temperature plasma from the outset, and the system, if successful, should be useful in the Stellerator and some of the other instruments.

Scientists Are Optimistic

Scientists, who normally are cautious men, tend to be surprisingly optimistic about one or more of these approaches. An AEC brochure at the Geneva exhibit, for example, states that when Stellerator C is completed in 1960, "it is expected to be capable of producing abundant thermonuclear fusion reactions."

Even if reactions are achieved, there is no guarantee that a true power-producing reactor is possible. But the stakes are so high in this game that most countries are boosting their ante each year. Since 1953 the AEC funds for fusion research have increased 1000 percent.

The best part of this game is that if one player wins, all win. It seems quite likely that within the next year, scientists at a laboratory somewhere on the face of the earth, will capture significant quantities of genuine thermonukes. And in 10 to 20 years, the first successful fusion reactor will go into operation.

Such a tremendous stride will herald the day when bottled stars will glow everywhere, and every man will have an incredible amount of power at his fingertips.

Ⓜ Don't be too sure that caviar you ate last night was from Russian sturgeon. They're processing caviar now from fish eggs of Ohio River channel catfish, freshwater drum, paddlefish and gizzard shad.

Do You Know This Old-Timer?

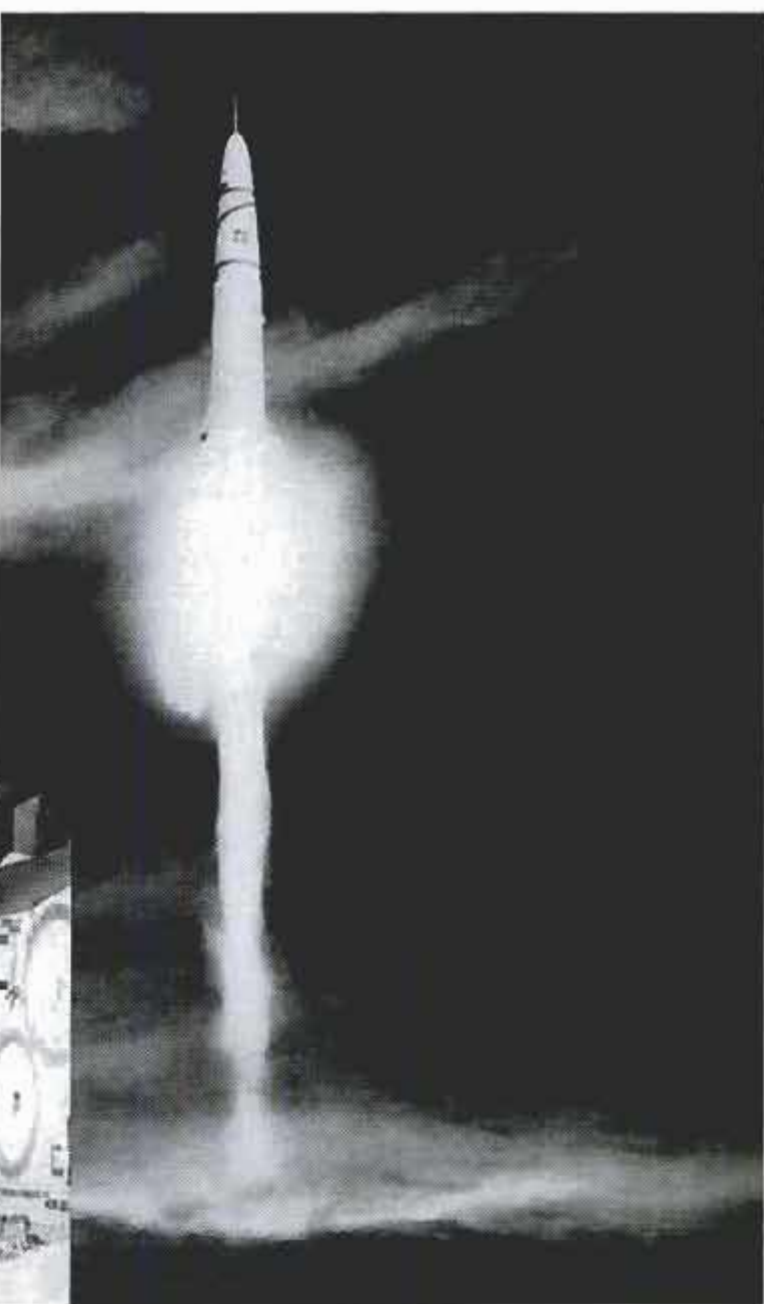
(answer to quiz, page 44)



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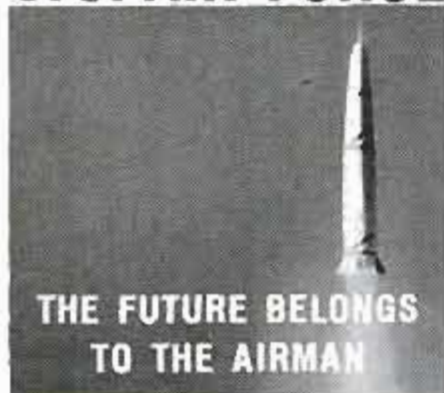
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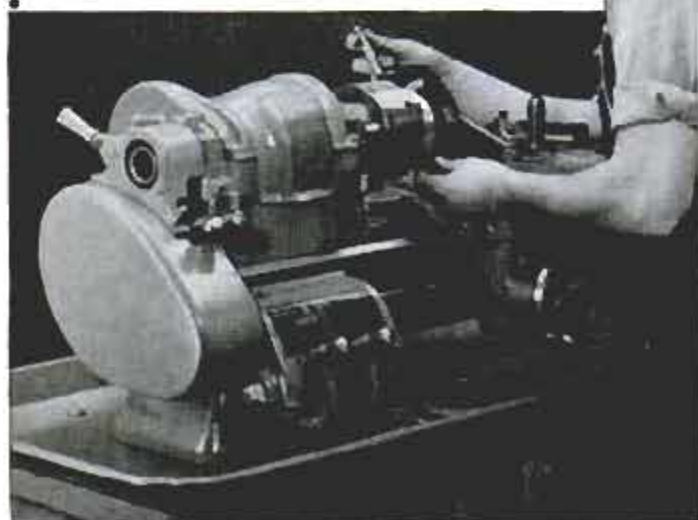
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SOUTH BEND LATHE
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Building Better Tools Since 1906



Stairway to the Sea

(Continued from page 102)

dredges, working under U. S. Army Engineers, are busy deepening harbors and interlake channels to the seaway's official 442-foot bottom width and 27-foot depth. Target date for the last of this work is 1962.

Locking through the seaway will be swift and efficient. At Eisenhower and Snell Locks, which began lifting lake steamers through their concrete walls last July, you get a preview of what a trip up the finished waterway will be like.

"We cleared a backlog of 109 ships in the first 48 hours of operation," Norman Ashley will tell you. Ashley is one of the lock control operators on the 3½-mile Wiley-Dondero Canal linking Eisenhower and Snell. "The Canadians up at Iroquois figured we'd be a bottleneck because of our inexperience with this type lock, but it turned out we kept them hustling. We've lifted ships the entire 45 feet in six minutes at this lock. On the old canal half that lift took 15 to 20 minutes."

Errorproof Control Console

In a glass-enclosed blockhouse, jutting from the lock's broad apron like an airport control tower, Ashley operates the great miter gates and flood valves at a console of lights and switches. "Everything works in sequence," he points out. "If the big boom isn't down, I won't get a circuit okay to close the gates. If the gates aren't closed properly, I won't get a clear circuit to open the valves."

At his big board, Ashley watches as a lake-bound freighter enters the downstream gate and sails into the cavernous lock chamber in which water has been dropped to downstream level. Actually, the new locks can take two lake steamers with room to spare. "A cabin cruiser wants to come through—let him in," Ashley suddenly shouts over an intercom to the downstream control operator.

"Those small-boat skippers," he explains, "are sometimes scared to come in with a big ship for fear they'll get banged all over the lock by water rushing in as the lock fills. Even in the Panama locks that happens. Here you'll hardly see a ripple as she comes up. Watch that little boat slip a bight over the floating bollard—that's all the mooring he needs."

Gates Protected by Fenders

The bollard, one of the new lock's innovations, is a floating mooring post that slides up a vertical track in the wall as water rises in the lock.

(Continued to page 272)

COAST TO COAST ONLY 1½ CENTS PER MILE FOR GAS!

Pontiac's new Tempest 420E V-8 sets the year's most important economy mark—Here's the story and what it means to you!

PONTIAC COAST-TO-COAST ECONOMY RUN

San Diego, California to Savannah, Georgia

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DISTANCE	2,442.7 MILES
DRIVING TIME	60.72 HOURS
FUEL CONSUMED	112.5 GALLONS
FUEL COST	\$35.79
MILES PER GALLON	21.7 Average for entire trip
AVERAGE SPEED	40.2 MILES PER HOUR
COST PER MILE	1.465 CENTS



We asked one of America's most respected car testers—"Uncle Tom" McCahill—to put a standard Pontiac Catalina Sedan with our new economy V-8 to the test.

And with only one specification—that the run would be exactly like *you* would drive coast to coast yourself—in mountains, in city traffic, across deserts, buying gas wherever the tank ran low.

And here's the phenomenal story in every complete detail—all officially certified by NASCAR, America's top automobile competition authority.

What does it mean to you?
Simply—and very importantly—this: For the first time, you can get deep-chested V-8 pep with better mileage than from many smaller so-called "economy cars" . . . and get it on regular fuel!

If you owned a Pontiac with this new Tempest 420E V-8 you'd be saving up to 5 cents a gallon on regular fuel. This new economy V-8 is optional at no extra cost on any Hydramatic Pontiac!

See your Pontiac dealer soon—and discover the newest in V-8 performance and economy!

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Auto Accessories and Parts**



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With both vessels tied up, Ashley and the downstream operator begin to throw switches in orderly sequence. The massive gates swing shut. Outside in the downstream canal, a huge girder lowers across the channel like a railroad crossing gate. "Each gate is protected by a fender like that," said Ashley. "It will stop an ocean freighter traveling at four knots."

Down below the control house, two giant whirlpools form outside the upstream gate as a pair of intake valves opens and gravity sucks a roaring torrent down through 15 by 16-foot culverts running through the sidewalls of the lock.

Deep in the lock chamber, the mirror-like surface of the water creeps up the foot-age markers, faster and faster.

Secret of the smooth lift, according to L. W. Angell, chief engineer for the seaway project, is a tricky system of intake ports. Instead of shooting straight up from the bottom, as it does in older locks, the rising water is fed through culverts in the sidewalls and shoots out into the 85-foot-deep lock bottom. Side ports from these transverse mains face each other, so that the water's tremendous energy is expended against itself. "We ran model tests that told us we had a good system," says Angell.

Plugs That Hold the Water

Going downstream, ships enter a full lock, and the water is dumped through outlet ports at the lower end.

Looking at the towering level of water outside the sheet of steel upstream of an empty lock, you can't help wondering what would happen if a ship should rupture that gate and let the whole upper St. Lawrence roar down the valley.

Not likely, according to Angell. The outside fenders protect that side of the big gate from ships. "Inside," he reveals, "two more fenders lying across the lock bottom lift up fore and aft of the ship to protect the gates from sharp prows and stern projections. This accounts for the fact that a 768-foot ship is the longest you can put into the 800-foot lock chamber. The difference is safety clearance."

That's not all. On the upriver side of Eisenhower Lock, facing the huge power pool, there's a superbackstop—a 350-ton vertical lift gate sunk in a deep slot in the massive concrete sill. "It will raise itself hydraulically," says Angell, "right through a full head of water roaring into the lock."

On top of that, beside each gate stands a crane and a pile of "stoplogs"—28-ton steel panels that can be dropped into slots just outside the gates.

(Continued to page 274)

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When it is finished, the new Seaway between Montreal and Ontario will climb through a total of seven locks, instead of 21, as on the old canal.

Far from being a recent brainstorm, the idea of slipping vessels around the cascades flowing down from the Great Lakes dates 'way back. Pioneering trappers and traders scooped out a tiny ditch around Lachine back in 1700 in order to float fur-laden freight canoes safely past white water. By 1908, Canada had built the chain of locks and canals that, until now, has carried small lake ships from Montreal to Lake Ontario. Slowly the 14-foot-draft canal was extended and improved.

Then came Canada's big dream—the joint U. S.-Canadian effort to broaden and deepen the channel and locks to accommodate ocean shipping. For nearly half a century the plan was kicked around by U. S. politicians and pressure groups. Then, in 1953, Canada threatened to build it alone. That did it! Within a year the St. Lawrence River valley became a bedlam of roaring machinery, shouting men and flying earth. Ontario's Hydro-Electric Power Commission and the New York State Power Authority combined forces on the power part of the project while the United States' St. Lawrence Seaway Development Corporation and Canada's St. Lawrence Seaway Authority tore into navigational problems.

Exactly 210,515,000 yards of earth had to be moved to make way for the giant seaway. If you piled it all on a football field, that much dirt would reach 25 miles in the air. Or, as M. W. Oettershagen, Deputy Administrator for the Seaway, puts it: "you could haul it away in 60,000 trainloads of 100 cars each."

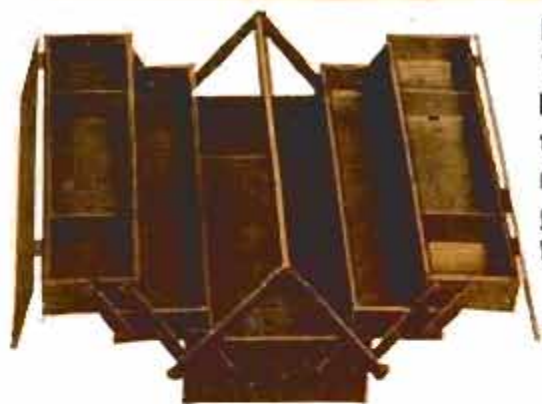
Tough Rock Wrecks Drills

None of it was easy. Paul Bunyan's fabled deeds pale beside some of the tales that are bandied about Massena, N. Y., where the heart of activity is centered. Canadian contractors on the Beauharnois Canal had to gouge their two-mile channel—to standard seaway depth of 30 feet—through solid rock so tough it wrecked the best steel drills in eight hours. Kerosene torches burning at 4000 degrees were used to soften it so blast holes could be sunk.

To make room for the new power lake that would flood 38,000 acres in the International Rapids section, seven complete Canadian towns were moved, lock, stock and tavern on the backs of gigantic, multi-tired house-moving flatbed trucks; 42 miles of highway and 35 miles of railway had to be relocated; 21 miles of dikes had to be built to contain the new waterway.

(Continued to page 276)

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Many contractors faced problems they'll never forget. Canadians, working through the crackling northern winters, had to blast great ice floes that threatened cofferdams; their fresh-poured concrete had to be kept under a barrage of steam jets to keep it from freezing. In summer, dredge operators, who had to work in white-water rapids, cabled their barges to bedrock ashore, or tied on to great blocks of concrete on the bottom to keep from being swept away.

Oettershagen likes to recount the adventures of an ingenious contractor named Badgett, who brought in a gigantic 650-ton walking dragline from Madisonville, Ky. "It had feet," he recalls. "Great snowshoe-like platforms, about 15 by 30 feet, with a camlike device that would pick 'em up and lay 'em down. Badgett inched that thing overland 18 miles to the Green River in 68 days, put it on a barge and sailed it up here. When a two-lane highway bridge got in his way he got permission to unhook it from its piers, lifted it on the dragline's boom, sailed down river about 50 yards with the bridge dangling, then swung around, put the thing back in place and continued on his way.

"In Chicago they told him he'd never run the Galop Rapids with that monster—but he did. Welded the whole works to the barge deck, dragged his big boom and bucket behind him in the river bed, like an anchor to windward, and shot the rapids in fine style."

Rhythm Breaks the Ice

Contractors didn't have all the ingenuity. When three-foot-thick river ice held up the start of spring construction on the power and control dams, Frank Matejka broke it up by opening and closing the control dam's new gates rhythmically and putting the whole ice table into harmonic motion. "We gained six weeks' construction time," he points out.

On June 30, 1957, everything nearly went galley-west when a hurricane's low-pressure eye literally tipped Lake Ontario backward, so that its water was several feet higher downstream than upstream! Bob Connors, one of Matejka's engineers, had the headache of facing all that water as it roared down from Iroquois on a wild night that knocked out all communications. Using radio cars to report water levels upstream, his gantries were still inching up gates in the unfinished Long Sault Control Dam when the wall of water hit Massena. "We barely got enough gates open," he says. "The level at Massena went to 204.4 feet—just 1½ inches from flooding the Cornwall canals on the Canadian side."

Job Finished on Schedule

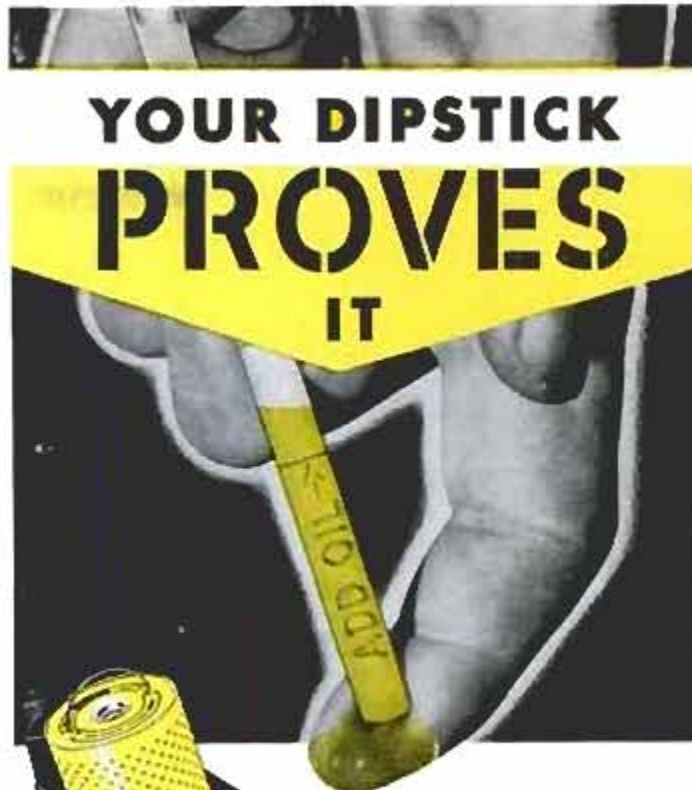
In spite of it all, the St. Lawrence was harnessed on schedule. "Last April first was deadline day for removal of the cofferdams at the powerhouse," says Matejka. "And on April first the last pile was pulled. May first was scheduled for commencing closure of rail and road access gaps in the dikes, and on that day we began pulling spikes. July one was set for the pool raising, and that was the day we blasted the cofferdam plug."

Today visitors can stand on any one of a dozen parks and sites, carved out of the river's lush banks and scenic islands, and look out on the inspiring sight of some 250,000 gallons per second of tumbling white spray as it roars from the two dams' batteries of sluices, marching across nearly two miles of river. Along the top of the 167-foot-high power dam, mammoth gantries, resembling four-legged stools for some giant to sit on, rumble along tracks atop the dam crest, raising and lowering gates to adjust the flow through the 32 big turbines (half for Canada, half for the U. S.) buried deep in concrete. Already, many of them are turning generators.

Everything you see is living proof of what the administrators cheer as an historic example of international cooperation.

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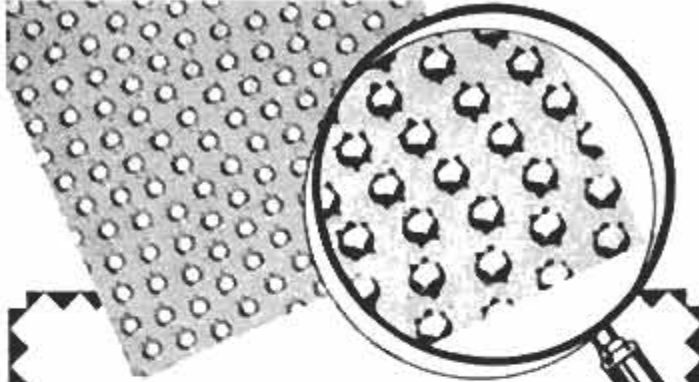
Next filter change, call for Hastings—for clean oil all the time.

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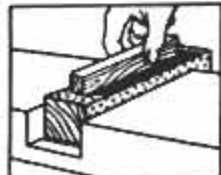
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Where Did the Inches Come From?

(Continued from page 175)

We add the usual 34 inches of torso height and three to five inches of excess headroom. Add these up and if you accommodate the center passenger you get about 54 inches minimum instead of 50 or 52—and therein is the big problem today of the Detroit body engineer.

You might be surprised at the difference in corporation policies regarding the relative values of comfort and convenience and styling lines. Ford Motor Company is probably the most conservative at the moment. Its low-pinion rear axles, step-down "Coke-bottle" frames and flat roofs have given reasonably low body lines while maintaining headroom and respectable cushion thickness over the tunnel. But its 1959 bodies are not quite so low as GM's and who knows which way Ford might jump in 1960?

The GM divisions have put a tremendous amount of time and money into engineering for low body lines while maintaining acceptable headroom and seat height. GM Styling set an arbitrary limit of 40 inches metal-to-metal distance between the top of the drive-line tunnel and the roof, measured near the center of the rear seat. Such a limit gives at least two inches of compressed-cushion thickness and four inches excess headroom. It forced engineers to concentrate on step-down frames (all GM uses them), roof and drive-line design. And it paid off with the lowest-looking line of cars among the 1959 model crop.

Chrysler Corporation, which was once the most conservative on things like seat height and headroom, pulled out all stops two years ago to get under competition. It lowered its bodies with a minimum of tooling changes. It uses no step-down frame and its floor line is above the frame rails. Seats and seat mountings had to be lowered to compensate. A single-piece drive shaft with the modest 1½-inch pinion drop meant a relatively high tunnel. This has been compensated somewhat by limiting the upward rear-axle travel by rubber stops and accounts, in part, for the superior stability in high-speed cornering of Chrysler products.

It is obvious from the above that major changes in chassis and body layouts will be necessary in order to take many more inches out of car height. There are several possibilities.

It would be simple if we could get rid of the center passenger in our sedans. The four-place Thunderbird is an example. It is 52½ inches high with excellent seat

(Continued to page 280)

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height and headroom. This type of body will most certainly grow in popularity in the years ahead.

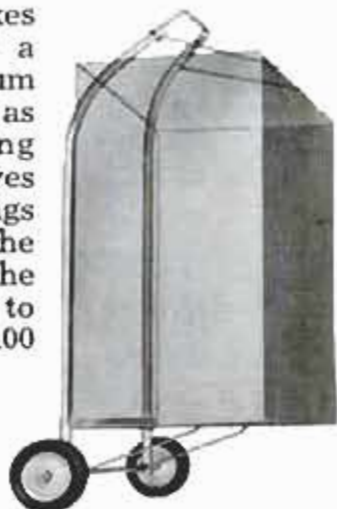
We'll get a substantial reduction in drive-shaft tunnel height by switching to independent rear suspension, in which the differential is mounted rigidly on the frame and the shaft doesn't move up and down at all—only the wheels. Look for this by 1961.

Ford is working hard on front-wheel drive which gets rid of the shaft altogether. Other things like lower-profile tires, smaller wheels, more compact rear axles, drive shafts in the form of a thin torsion bar instead of a big tube will help also.

No, sir, you haven't seen anything in lowness yet. Your car will be lower tomorrow! ★ ★ ★

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Injecting an extract of bee venom under the skin makes some people less sensitive to bee stings, according to a South African medical scientist. The extract is made by grinding up whole bodies of bees, since this is easier than preparing an extract from stingers alone. The extract was reported successful in 19 of 24 cases treated.

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Here's What Ford Stylists Say

(Continued from page 178)

MAGUIRE: Well, my wife likes the size of it, yes.

WALKER: And my wife likes the size of it.

MAGUIRE: I'm not denying the size thing altogether. The fact that the Thunderbird is smaller than the Lincoln appeals to her. But she has told me that she would just as soon drive the Lincoln. It's as easy to maneuver as the Thunderbird except in parking. I think the Thunderbird sells because of the spooky, lush quality of it. It's a distinguished car.

WALKER: They keep talking about cars being too big to park. How many times does a person park a car or get in and out of it in a day? We say somebody gets in and out of a car about four times a day. That's not very often. Why would he forsake good silhouette and design just because it knocks his hat off a few times a day? If we were designing a milk wagon we would make it high enough so a man could jump in and out without knocking his hat off.

MAGUIRE: The Thunderbird is very low and I don't hear any owner complaining about it. I don't think size has as much to do with its success as you seem to think. People are buying it because it's a spooky style leader. I am distinguished when I am in it.

WALKER: But I am sure that if it sold for \$3000 you'd still see a lot on the road. It wouldn't be as exclusive, but it would sell just the same. The balance of the car is so nice, the silhouette is so nice, it could be the concept of a whole new line.

QUESTION: When are you going to have a four-door version?

WALKER: I couldn't answer that. I don't know.

QUESTION: Would a four-door model hurt Lincoln's business?

MAGUIRE: I think you could say that it is hurting Lincoln's business right now. That is one thing that makes it so difficult to make decisions in this business. Lincoln is trying to sell a quality car. What is a quality car? A big one? Here we have a quality car that's a little one.

QUESTION: Isn't it true that by the time you can afford a fine car you probably don't need a big one?

WALKER: Well, there's a yes and no to that. The American public is aggressive, it's moving upward all the time. The average man still likes that up, up, up, and that means bigness. When the American workman gets a little more money he wants

(Continued to page 284)



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a bigger house and he wants a bigger car. You can't change that.

QUESTION: A favorite with the Detroit detractors at the moment is sex symbols. Is there any deliberate attempt to put sex symbols in cars?

WALKER: Absolutely not.

MAGUIRE: A car gets into a face symbol very easily with its headlights that look like eyes and a grille that looks like a mouth. Sometimes you work like a dog for a couple of weeks on a front end and you come in one morning and you've got a mouth with four teeth in it, with eyes over here and a nostril opening in the power dome. It shocks you. You wonder how you could go that far without noticing it.

QUESTION: Why do we need four taillights? They don't tell you anything more than two.

WALKER: They give balance when they're done right. And they are a decoration that makes a little more flash and splash at the rear.

MAGUIRE: Let me say something about the size of taillights. Why shouldn't a taillight be a big thing? When Ford stoplights go on you know it's stopping. When I drive down the highway I miss those big lights if they're not there.

WALKER: Taillights are partly safety and partly styling. They add an exciting element to the design. Of course, you can get bizarre with it if you're not careful.

QUESTION: Why do you insist on hiding the gas filler pipe?

MAGUIRE: Why shouldn't it be concealed? Who has to know where it is? Only the gas man and he knows.

ENGEL: It's just an ugly square shape on the side of a fender. It helps to get it out of sight, smooths up the lines.

MAGUIRE: That's a funny question because it's the kind of question that's hitting us now. It's the "gray flannel" question. It's asked by the same people who write that automatic transmissions are terrible and we should go back to the stick shift. This is the year to be against automobiles. But, good heavens, would those people want to get rid of the automatic oil burner in their homes? Is there merit to shoveling coal? Why stop at the stick shift? Why not go back to the tiller? Why not go back to the horse? Where do you stop?

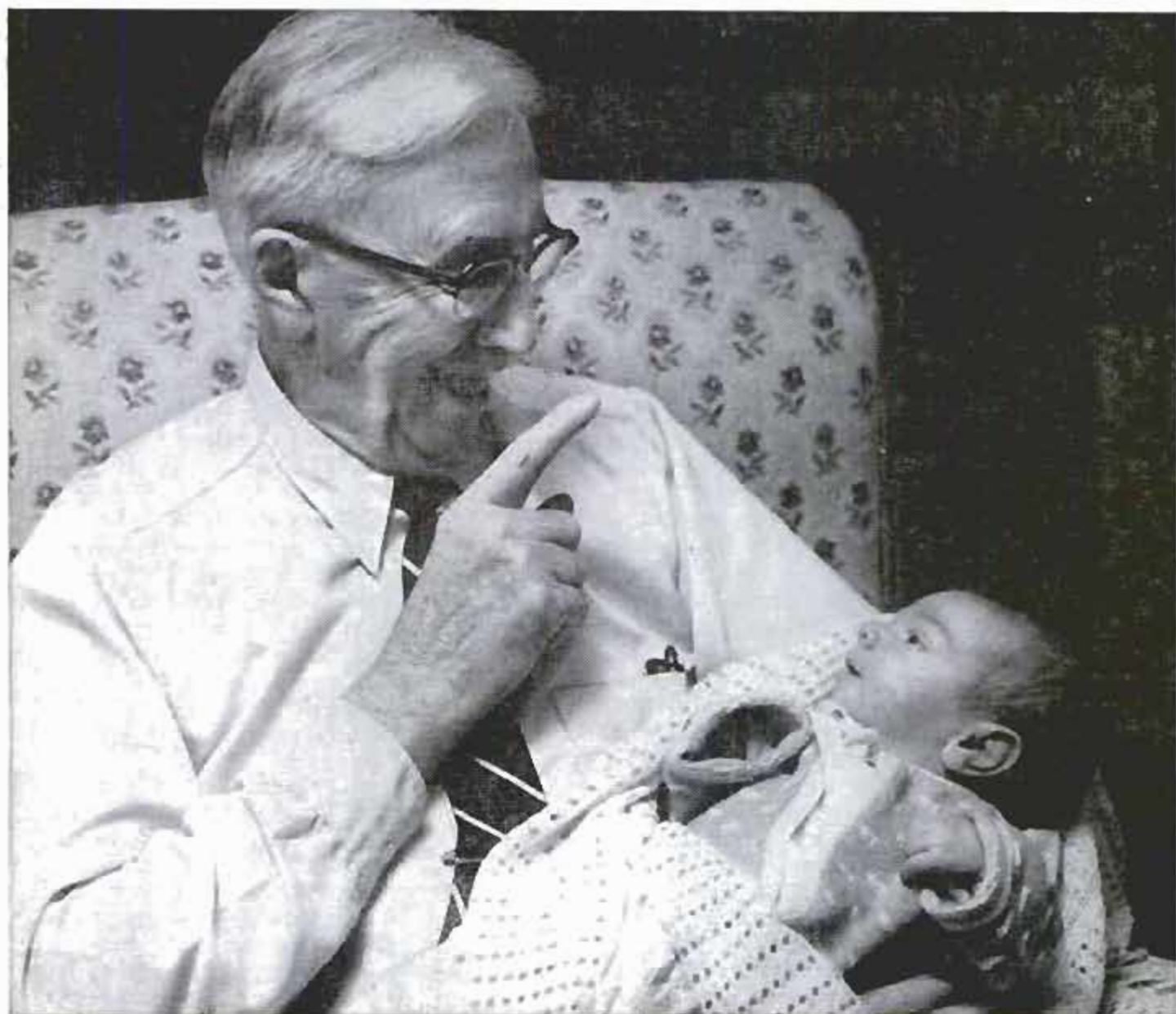
ENGEL: I can imagine what the car would be like if we designed one to please those people. It sure wouldn't sell.

QUESTION: Is there a lot of circus in this automobile business?

MAGUIRE: I don't like that word. I suppose it's showmanship. We're not merely

(Continued to page 286)

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problem solvers although we have to solve problems. We design a car and the minute it's done we hate it—we've got to do another one. The 1957 Ford was great, but right away we had to bury it and start another one. We design a car to make the man unhappy with his 1957 Ford along about the end of 1958, so he'll buy another one. Planned obsolescence, I guess. It's a nasty word nowadays, isn't it?

QUESTION: Is it really necessary—this planned obsolescence?

MAGUIRE: It is, if the country is to keep on doing what it's doing.

QUESTION: Are cars going to get any longer?

ENGEL: I would say not. Not much longer.

MAGUIRE: Sounds logical, but I hate to make such a statement.

ENGEL: I'd never say they weren't going to get any lower. I don't know how low they'll go.

QUESTION: Will perhaps all cars be about the same length with the differences being in luxury, in lushness?

MAGUIRE: We're getting close to this now. The new Buick is big, but it doesn't look as big as it did. That's a funny thing. We used to be proud of making a car look longer than it really was. Have we reached the point where the trick is to make a car look shorter than it is?

QUESTION: It appears that the stylist has taken the ball and run with it, leaving the engineer in the shadows. Is this true?

ENGEL: When a person walks into the showroom to look at a new car he doesn't see the engine. Sure, the engine is important, but the customer sees styling first.

MAGUIRE: Engineering is less of a problem than it used to be. Cars run now.

QUESTION: What's the truth about the industry's espionage system, which is supposed to inform each company what the other is doing years in advance?

ENGEL: I don't know anything about it. Styling doesn't have anything to do with it. Any information we get somebody else gives us.

QUESTION: Is espionage widespread?

ENGEL: I don't think it's as big as it's made out to be. I think a lot of it comes when a stylist moves from one company to another. If a couple of guys left here today they could tell General Motors or Chrysler exactly what we're thinking about for '61.

MAGUIRE: We never find out things early enough anyway.

QUESTION: How important will styling be to the success of the small car?

ENGEL: Price is the most important thing on the small car, economy of operation is second and then styling, I would say. The owner is buying transportation and economy, not styling.

MAGUIRE: I'm not so sure. I have never seen a poor man in a Volkswagen yet. I have seen gray-flannel nonconformists in Volkswagens, but I don't think they're after economy.

ENGEL: The Volkswagen is an ugly car, but it's economical and it sells. They haven't changed that thing in 15 years. They've got a good thing there and they probably would ruin it if they changed it. Maybe they're better off not worrying about styling—it's no bed of roses designing a car. When you get into the financing, production and the public taste—it's a real tough problem.

WALKER: That's right. It's not like designing a vacuum sweeper or a TV set. You've got to remember to be "automobiley." That's Maguire's word for it. Engel, here, has the concept of the nice, crisp line that has been characteristic of Ford products. We think that our competitors are becoming aware of the crisp highlights of our concept of styling for the first time this year and we're flattered. ★ ★ ★

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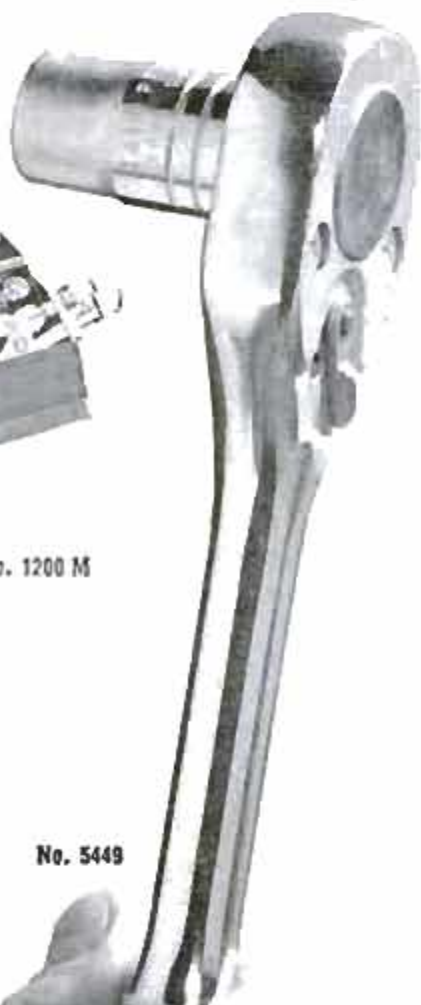
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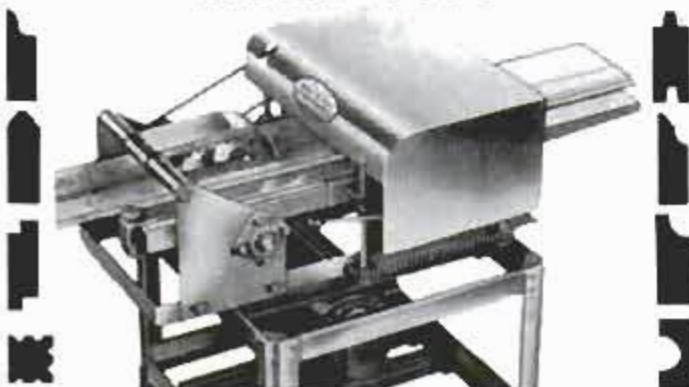
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Here's What Chrysler Stylists Say

(Continued from page 179)

in the chassis, such as moving the trans-
mission to the rear, but they would be
very costly.

QUESTION: The public seems to be
showing better taste about furniture and
homes these days. And cars too, I think.
But it seems to me that car interiors are
still very garish when compared with liv-
ing rooms. Why are they that way?

EXNER: The type of interior we are do-
ing is what the sales department has in-
dicated that the buyer wants.

SCHMIDT: It's the same story as the ex-
terior-chrome story. We designers would
have very few moldings if we had our way.
But if you put a chromed-up job beside a
plain job in a showroom, in most cases the
car with the brightwork will sell sooner
than the plain one.

EXNER: Perhaps it is the initial im-
pression that sells. Maybe that is where
this extra "busyness" is needed.

SCHMIDT: Remember we are merchan-
dising people. A stylist is here to design
cars that will sell, so we must satisfy the
tastes of most people.

EXNER: Product planners may feel that
the busy design makes the average buyer
think that he is getting more for his money.
But there is a very slow move towards
greater simplicity and we stylists like it.
But we may have to get busy again later.
Look at the appliance business. Washing
machines are simpler to use than ever, but
they are designed to look busy.

QUESTION: A favorite charge of the
iconoclast is that of sex symbolism in styl-
ing. Is there anything to this charge?

EXNER: Absolutely not. Frankly I
think that's coming from people who are
more concerned with that sort of thing
than they should be.

QUESTION: What about the push-but-
ton control? Is it a styling or an engineering
device?

EXNER: It's a combination. It's a very
simple, functional control that meets both
esthetic and functional requirements.

QUESTION: Don't you think all controls
of this type should be standardized?

EXNER: Strictly from a safety stand-
point, I could see that it would be an ad-
vantage to have every transmission control
the same. But if you come out each year
with exactly the same arrangement, some-
body is apt to say this instrument panel
doesn't look much different from my old
one. You have to have new arrangements
to make the panel more attractive, more
exciting.

(Continued to page 290)



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SCHMIDT: The whole industry puts the light switch at the extreme left side of the panel so you know where you reach to turn on the lights in the dark. It's not a written law but we all do it—perhaps there will evolve some similar system for push buttons.

EXNER: I think the stylist has a right to put the buttons in a new location if he wants to, providing he can find an equally functional location. He almost has to have this freedom because the dashboard arrangement is never fixed—it changes.

QUESTION: Why is so much effort spent on hiding the gas filler pipe?

EXNER: One reason could be that shapes are more complicated in the quarter panel and you don't have the right kind of surface for placing the filler cap.

QUESTION: Isn't upholstery unnecessarily luxurious for use in the automobile? Shouldn't it be more practical?

SCHMIDT: In general, upholstery is expensive and getting more so. We're going to materials that have bolder, tweedy effects. Instead of putting a lot of trim on the seat as we do today we're coming out with striped materials that have the design right in them.

EXNER: Of course, we put sprays on fabrics so they can be washed. And they are impregnated with solutions so you can spill ice cream on them and still wipe it off. You couldn't do that with most upholstery on your home furniture.

QUESTION: Why must we have such a broad, useless shelf over the dashboard? It reflects sunlight and takes up needed legroom, doesn't it?

EXNER: Just put your hand under there and you'll see there is no wasted room in it. We must leave space for a radio, a speaker, for air-conditioning parts as well as other things.

SCHMIDT: That's proved by the small glove boxes. They are left until last, after all the functional units are located. That is the most complicated area in the body.

QUESTION: Why do we have expensive-looking carpeting in cars? Why not rubber mats?

EXNER: It's not so expensive. A rubber pad would be more practical, but the buyer certainly prefers rugs. They look much better.

QUESTION: Stylists have been saying cars won't get much longer for 10 years now, yet they keep getting longer. Will cars continue to get longer?

EXNER: I really don't feel that they will get much longer. We're asking for fractions of inches now. There won't be the increases in the next five years that

(Continued to page 292)



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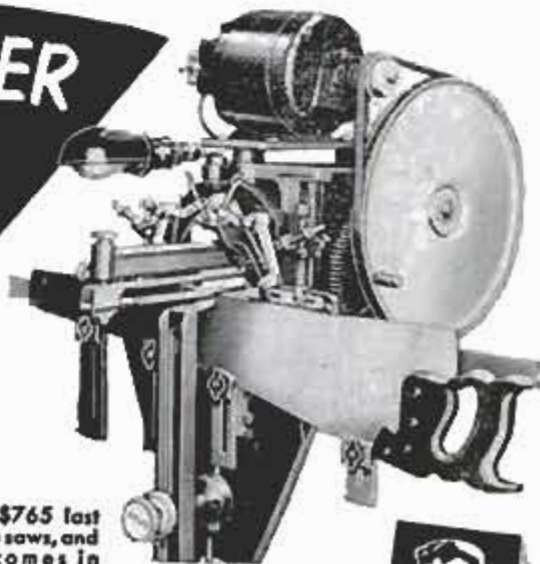
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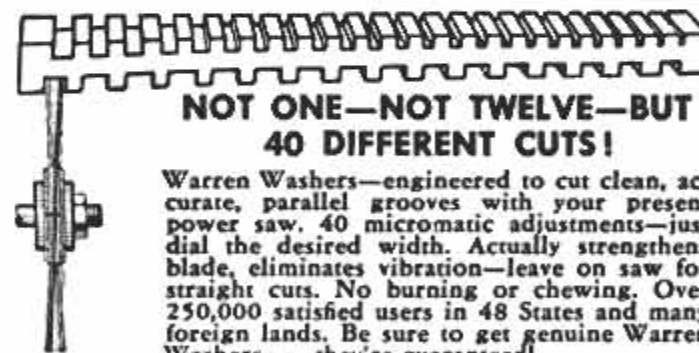
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there have been in the past. Maybe we need a little more clearance for bumper protection or for taillight clearance, but that's all.

QUESTION: There seems to be a tendency for all cars to be getting closer together both in size and in luxury. How do you keep your Plymouth from looking more expensive than a Dodge, for example?

SCHMIDT: You put more money into the fabrics, in the carpets, in the engine. The cost factor automatically keeps the cars in proper price categories.

QUESTION: Suppose you came up with a design that was elegant enough for the Imperial yet cost no more to make than a Plymouth. Would you make it an Imperial or a Plymouth?

SCHMIDT: You wouldn't say that just because it was cheaper it was in the Plymouth bracket. If it fits in the Imperial picture you'd make it and spend any money you might save on the rest of the package, on the fabric, the carpeting, the hardware.

EXNER: We call it horsetrading. If we can save \$5 on a rear bumper we might take that money and put it into a more expensive grille. We are given a cost target. We don't have to spend a certain amount on each part of the package, but the total cost must not exceed a certain amount.

SCHMIDT: Elegance usually costs more. Low-price cars often have an inexpensive stamped grille. You touch it and it's sharp. It rattles in the wind. The die-cast grille costs more money and looks more elegant. It adds richness. You feel it and you know it costs more. It's stiffer and doesn't rattle in the wind.

QUESTION: What would you stylists do if the industry gave up its annual styling changes?

EXNER: There would still be plenty of work because there will always be this desire to have something better looking than the other fellow has.

SCHMIDT: We just wouldn't be so rushed.

QUESTION: Will the day come when the automobile will be completely devoted to passenger space, from stem to stern, rather than being divided into engine compartment, greenhouse and trunk?

EXNER: It's always easy to predict in this business because if you live long enough it will probably happen. But that hinges on the size of the power plant.

QUESTION: Do you think engines are coming down in size rather than getting bigger?

EXNER: I think so. They will, I think, get more efficient so they should get smaller. But that's strictly in the prediction department. Strictly a guess. ★ ★ ★

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EXCESS INVENTORY
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● 2500-w, 115-v, 60-c. 269.00
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● 3000-w, 115-v, DC Gen. 49.50
● 2000-w, 115-v, AC Gen. 99.70
● 5000-w, 115-v, AC Gen. 291.50

STORAGE BATTERY WINCH

● Powerful fully reversible ball-bearing gear reduction winch. 1000-2000 lb. pull. Use on 6 or 12-v battery. Holds 40' of 1/4" cable. For trucks, docks, boats. Wt. 54 lbs. Govt. cost \$280. SALE.....\$46.75 FOB

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● Modern hi-efficiency attractive dial phone. Use for extension to main line on private system. Use several for complete private system, etc. Complete with ringer, dial, etc. Work on any system. Govt. cost \$25.00. SALE.....\$9.95 Ppd.

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Fuel injection was virtually abandoned. Only one of the 1959 cars now offers it—Chevrolet. Pontiac and Chrysler dropped it so quietly no noise was heard. American Motors did also (in fact, AM hardly picked it up after its first flurry of publicity early in the 1958 season).

Push buttons went back into the Ford archives as Edsel (which last year was almost synonymous with push buttons) and Mercury decided they weren't worth the extra cost and effort.

Mention of Edsel brings to mind that this car celebrated (with muted horns) its first birthday. It was far from the lusty infant we had been promised at its christening party last year. It had picked a bad year to enter the medium-price field and its dream of 200,000 cars in the first year became a reality of only 63,000 cars.

There was a death, too, in 1958. The great name of Packard was removed from the roster. The Packard car had been buried in Detroit a few years earlier when it was moved, in name only, to South Bend to become a luxurious version of the Studebaker. Now the masquerade has been given up and the name Packard has been put into a crypt beside Hudson and Nash.

But let's not linger in the graveyard. What about 1959? There have been some startling changes in product personalities, perhaps the most radical in history.

There was a time when the rash style leader, the car for the flashy set, was Ford. The Chevrolet was quiet, unobtrusive, substantial, but certainly not rash. Plymouth (after a long career as an old maid) became the glamor girl of 1957 and the young-in-heart turned toward it lovingly. Now what has happened? Ford this year describes itself as the car with "dignity" unlike the "gaudiness or extremism" of its competitors. Chevrolet has switched faces and is now the industry's jazz-wagon. Plymouth is somewhere between. We've had a complete switch of roles—as though you had to learn the cast of characters all over again right in the middle of the third act.

Buick, too, has transmigrated. Gone is its fat, prosperous, overstuffed look, replaced by a sleekness, an alertness, that looks almost indecent in garages of long-time Buick owners.

Pontiac has had a similar change and Cadillac, once dignity on wheels, has entered the spaceship era.

Generally, styling is less "buckeye," less cornball, than in previous years. There is evidence of the increasing maturity of both

(Continued to page 296)

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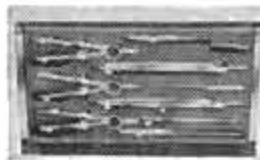
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(Huot rhymes with "do it")

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the American stylist and the customers. Glass is everywhere, with problems. Double-wrap windshields cut into the roof, causing annoying reflections on the inside of the glass. Rear windows curve well up into the roof, exposing rear-seat riders to the summer sun like plants in a hothouse. Glass is heavy, boosting car weight. Glass is expensive, boosting costs and insurance rates. But glass makes cars look modern and, the stylists hope, makes them sell.

Manufacturers are trying hard to mollify the customer. Today's cars may be bigger with more sheet metal to take care of, but they don't have to be polished, so permanent are the new paints. At least, that is what the manufacturers claim. It is unlikely that car owners will give up this inexpensive form of recreation, however.

Exhaust systems are made of heavier metal, are coated with noncorrosive materials, are made with double-wall designs to lessen condensation, as companies try to increase the life span of this, the first to go of all parts.

Power steering is more effortless this year. General Motors has moved to the Chrysler concept of a full-time power assist. GM cars handle better than ever due to this and to their lower center of gravity.

Economy is the word of the year. Cars may cost more, but they're cheaper to run, say the ad writers. Refinements in the automatic choke of the 1959 Cadillac increase gasoline mileage by 10 percent. This could save the buyer of that \$6000 machine about \$20 a year—a critical saving, we all know, in the budget of a Cadillac owner! Yet the idea that gasoline economy is so important to the Cadillac owner indicates a trend.

More cars advertise that they use regular gasoline. Last year, they were bragging about their higher compressions, which made use of regular gasolines impossible.

And so the pendulum swings. But the full arc of the swing won't be realized until next fall when the industry presents its first really new car, the first completely new design, the first "we-started-with-a-clean-sheet-of-paper" model since the Model A replaced the Model T.

What this new small car (and there will be at least two of them by 1960) will do to the industry is anybody's guess and certainly you are entitled to make your own.

This reporter's guess is that within five years, these new "small" cars will have become the top-selling models and will bring back a once profitable export business.

As in musical chairs, there may not be enough seats to go around when these new cars take their big chunk of the market. Which makes will be left standing? Now it's your turn to guess! ★ ★ ★



DRAFTING MACHINE For engineers, draftsmen, designers, architects. Portable. Complete with 11 in. x 17 in. hard surface drawing board with scale divided in 50ths to inch and 180 deg. protractor. This unit is not a toy, it's the real McCoy! NEW. While they last—\$10.50 ppd.
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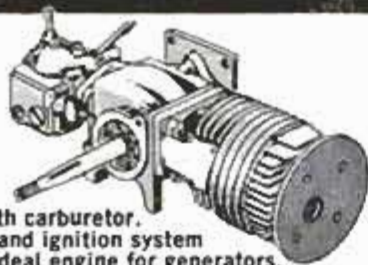
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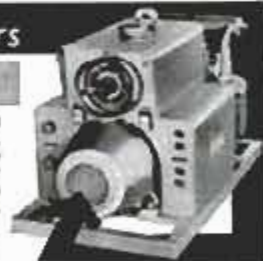
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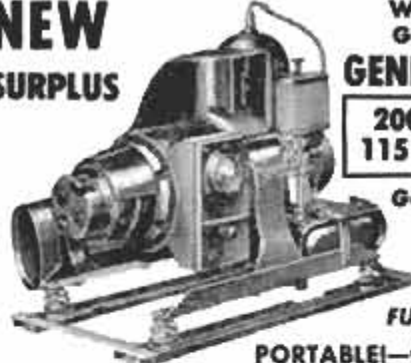
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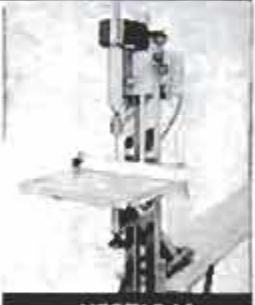
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The Foley 314 Grinder puts a perfect cutting edge on all rotary power mower blades.



with these 2 machines you can sharpen ALL HAND AND POWER LAWN MOWERS

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With the Foley Grinder you can sharpen rotary power mower blades, rip, cross-cut and combination circular saws, dado heads, ice skates, knives, scissors, shears, all sharp-edged tools.



FREE PLAN tells how to put yourself right into a home business that will pay you \$3 to \$6 an hour. Send coupon today for **FREE BOOK** on how to sharpen power mowers and Special Combination Money Saving Offer. No obligation—no salesman will call.

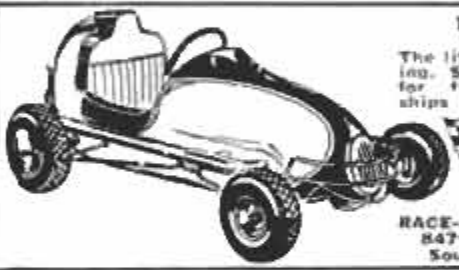
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